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Editorial

The Weakest Link

In the institutional chain that provides support for the industrial and economic development of the country, universities are currently the weakest link. Since the strength of the chain is that of its weakest link, it effects the total system. Universities have the responsibility of providing trained scientific and technical personnel which form the backbone of research institutes and industry. The industrial growth and the ability of the industry to develop a self-generating and self-reliant status is directly linked with the quality ot the men that are made available to it from the universities, training institutes and the institutes of engineering and technology. Unfortunately, it is these very sources of trained manpower that have not come upto the level where they could meet, in quality and quantity, the growing requirements of scientific and technical personnel. While number of trained scientists and technologists turned out by the universities is itself inadequate and would need to be multiplied manifold, the greater weakness is the quality of even the limited numbers that pass out of these institutions.

If all the wise words that emanate from the ministers, politicians and the eminent educationists in convocations to the fifty and odd universities year after year, had any effect, the recent unsavoury happenings in Aligarh, Banaras and Lucknow would not have been witnessed. Neither the state of discipline and atmosphere for work nor the administrative functioning of most of the universities, particularly the scientific and technological departments, are such as would inspire confidence in their ability to train a future generation of the required calibre. It is not necessary to await the report of the Education Commission to draw pointed attention of the concerned authorities to the deplorable state of the intellectual life and teaching conditions in most of the universities. If the words of Dr. Melvin Cohn, the Nobel Laureate and a Professor at Salk University in California, who recently visited some of the universities, are any indication of the real state of affairs, something drastic would have to be done to stem the rot. He has stated that science teaching in India is a hundred years behind the times and that intellectual life is stifled in our universities. He has also pointed out that until Independence, little attention was paid to research and even today the bulk of research done in the universities is pure rather than applied. It is also characteristic of Indian universities that a handful of senior heads of departments make key decisions without bothering about the opinion of their juniors, however brilliant. The teacher-student ratio is disproportionate and the majority of staff are underpaid and over-worked which leaves them little time or inclination for research. The majority of universities are in the hands of veterans out of touch with the modern world and the teaching syllabus both for postgraduate and undergraduate work is old fashioned and unrelated to contemporary developments.

The present syllabi and text-books used in the universities could usefully be consigned to scrap heaps which alone would improve the standards of teaching and research.

The question arises why do we have to await the words of a Melvin Cohn to know all these things? Do the concerned authorities think differently or are ignorant of this disturbing state of affairs? In any case now since they have been warned by an international authority, what measures, if any, they propose to adopt to improve the situation in this crucial field. The future of the country should not be permitted to be held at ransom by the vested interests in the field of university education.

To make a beginning in the direction of improvement, it would be well to begin with the top. It has come to an accepted practice that vice-chancellorships like governorships are there to provide cushy jobs and retirement benefits to favoured politicians, superannuated civil servants, frustrated politicians and even an odd minister. The key role of the vice-chancellor's post is operated by persons whose interests are anything than academic. Let the dead wood be removed and all those who do not have ability and experience to function as heads of educational and teaching institutions vacate the highest seats in the universities. Only men of proven ability in the field of scientific research, teaching and training should be eligible for the posts of vice-chancellor. Next should come a rapid survey of the achievements or lack of them in the various teaching and training departments of science and technology at the various universities. If some heads of the departments and professors, who enjoy key positions, are more adept in political manoeuvring than academic teaching, they may be permitted appropriate avenues for their talents elsewhere. If the posts of vice-chancellor are held by persons of ability and integrity, it should not be difficult to extend the process to the heads of the departments and professors. Ample retirement benefits and attractive compensation should be provided to those who may volunteer to vacate the seats of learning in favour of more lucrative professions if their performance raises doubt about their future usefulness in the universities. The next step would be toning up of the teaching departments and seeing that even amongst the younger teachers only those who have interest and the aptitude for the teaching job and research are retained. One of the major factors of lowering standards in the universities is the inbreeding and favoured employment of its own alumni into the teaching cadre. It would be a healthy rule if no university was permitted to employ more than a certain percentage of its own grduates into the teaching departments. It could even be that no graduate of the same university can enter the department excepting if he has already gone out and worked for a minimum period either in another university, teaching institution, industry, research laboratory in the country or abroad. It will provide healthy intellectual stimulus if a larger number of teachers are drawn from the research personnel from industry or from the research institutes. In no case should the universities become the employment grounds for products of their own teaching.

The present system in most of the universities where by the juniormost lecturer takes up the freshers' classes fails to make the right impact on the minds of the students. Although a number of professors in the Indian universities have received education abroad where it is an established practice that the fresh classes are taken by the seniormost professors, in India administrative seniority regulates the system of teaching. As a result a lecturer who himself is a fresh graduate is put incharge of freshers who thus make a poor beginning in their education.

The country cannot progress if the syllabi and text-books with which the younger generation are taught, continue to be 50 years or a century out of date. This only points to the laziness of those incharge of teaching who would rather deliver a lecture over and over again which they have learnt by rote than put in hard labour and prepare an interesting talk based on modern developments as reported in the latest scientific journals. Unless a teacher is himself engaged in research, he can hardly be expected to take interest or keep abreast of the latest developments. It would help if teachers are permitted, every three or five years, to spend a year or so in the research institutions and national laboratories either on the basis of deputation or exchange with corresponding personnel. Healthy contacts with research institutions at an academic level combined with periodic exchanges of personnel, joint discussions and cooperative working on problems of common interest would do a lot to give a new edge to teaching and research in the scientific and technological departments of the universities. Unfortunately, at present, the authorities in most of the universities do not encourage such contacts.

Within the teaching departments of the universities themselves a lot needs to be done to break the absolute strangle-hold of the professors and heads of the departments who enjoy and exercise powers which militate against a healthy and democratic intellectual set up. A greater degree of democratisation and sharing of responsibility and authority between the lecturers and the heads of the departments whereby the head of the department is more a coordinator than an autocrat, can give a greater sense of participation to the younger lecturer and permit him to function more effectively. Such a practice would also lessen the damage done by the stifling atmosphere in these departments referred to by Prof. Cohn. Alongside, the universities must improve their pilot plant and prototype facilities to give a technological edge to their teaching and training. Equipment and facilities provided in most of the universities are inadequate and as a result there is a greater tendency to take up problems of abstract and pure fundamental research. In the industrially advanced countries, technologists and engineers outnumber several times the pure science graduates but in India the current training provides for a larger number of pure science graduates. Even the IITs which are expected to be in the forefront of technological and engineering education, are poorly equipped in matter of prototypes and pilot plants. Here again the contact and cooperation between research institutes and teaching institutions would be to mutual benefit. The teaching hours in the educational institutions, if they are heavy, must be reduced and incentives provided to the teachers to devote greater time to research. The administrative rules and procedures in the universities and IITs are also unsuited for the efficient functioning of these institutes. While the present administrative procedures may be of some utility, however doubtful, in a government department they have absolutely no place in a teaching institution much less in science and technology departments. There are rules which prescribe that orders for purchase of equipment, apparatus and chemicals can be placed only by the head of the department and then processed through Registrar's office—by the time the chemicals and apparatus are received, the year is out. Such delays are inexcusable in a developing country. A system of pooling and coordination of information regarding availability of equipment, apparatus, chemicals, text-books, documentation, repair and maintenance of costly equipment and instruments should be the responsibility of some

(*Continued on page* 12)

Frankly Speaking

Bureaucrats Galore

We owe it to a recent news item, the announcement, that a gentleman who has been in the Reserve Bank of India, Joint Secretary in an administrative department, held a post in the State Trading Corporation, has now been appointed to head a public sector undertaking of a high degree of technological complexity. We are aware that the administrative services in India have produced some men of ability, intelligence and administrative acumen; capable of handling an assortment of varied assignments. Such persons are a valued few—the majority of the rest only helping the physical build of the steel frame. To a hangover of our past, must be ascribed this peculiar state of affairs, where appointments requiring a high degree of technical and specialised knowledge are offered on a platter to professional adminis-of trators. It is no surprise that most of our public sector undertakings fail to fulfil the targets and are no models of technological, managerial or economic efficiency. With non-technical personnel at the top, research and development activities have not received due encouragement. Foreign collaborations have been the favoured mode of running the public sector undertakings, which give these top men, a lot of administrative authority with little or no technological responsibility.

We are categorically of the opinion that such a system does not meet with the needs or requirements of industrial development. We must build a system of 'technocrats', as in other advanced countries like America, U.K., Germany, or Japan where technical persons with administrative ability are the only choice to head the industrial undertakings or even the technical departments of the administrative ministries. Authorities responsible for these appointments should wake up to meet the demands of the era of science and technology. Management of public sector undertakings on which the common man has invested his hopes of better days to come, must rest in the hands of technocrats and this should be on the basis of a firmly laid policy.

Role of Science in Economic Development

Dr. V. B. Singh

I. A Perspective

The process of interaction between Man and Nature, with a view to providing the former with the means of livelihood, has resulted in a series of social orders, some of which have developed into civilizations. In the creation of these organizations, during milleniums, Man has faced the problem of changing equilibrium of social relationships. Every change in Man's relation to his environment means some change in his relations to his fellow beings. This also means a growing process of social adaptation, which takes place, at least, on four levels : Physical, Biological, Technological and Economic. What are the basic problems of adaptation on these levels ?

On the physical level, Man protects himself against Nature's crudities and roughness expressed in earthquakes, storms, floods, seasonal climatic variations, changes in temperature, etc. In adapting himself to these changes, Man orders not only Nature but also himself. On the biological level, Man not only perpetuates and protects the human race but, through procreation, enlarges it. For earning a subsistence for an ever-enlarging humanity, Man utilizes the resources available from the plant and animal kingdoms. This ecological adaptation is a two-way process. On the technological level, Man changes his techniques of production and discovers and invents new tools to satisfy his ever-increasing wants. Each innovation leads to a new division of labour, which in turn, gives rise to new inventions. On the economic level, Man finds it difficult to use a given organization for utilizing newer techniques, which are constantly changing. Therefore, he sets up new organizations to make full use of the new technology. The history of these forms of adaptation constitutes a study of the changing patterns of social relations.

For eking out his livelihood, Man had achieved many technological landmarks such as the discovering and taming of fire, the domestication of animals, the invention of the wheel, the discovery of agriculture and irrigation, the smelting of ores and the use of metals, the invention of scripts, paper and printing, marine compass, gunpowder, Indian numerals and methods of calculation. But the maturing of Industrial Revolution was, both qualitatively and quantitatively, an instrument for fundamentally changing the social fabric of life. With the dawn of Industrial Revolution characterised by centralised mechanised production, on the technological level and the emergence and combination of two antagonistic classes, the wage earner and the entrepreneur, on the organizational level, the traditional source of crude power(from man, animal, wind and water) was replaced by steam power. This created an unprecedented opportunity for the development of science and technology. In due course of time steam power was gradually replaced by electric power. With the explosion of atomic bomb in Hiroshima the world witnessed the emerging potentialities of the Second Industrial Revolution. These new scientific and technological potentialities, however, have, under the impact of the cold war and armament race, created weapons for destruction, and not for ensuring human happiness. Referring to this, the U.N. Report on *Economic and Social Consequences of Disarmament* appropriately states : "If human ingenuity, in the space of a few years, has so vastly increased man's power of destruction, it should be able to make an equally massive contribution to peaceful and constructive achievements."

The centuries preceding the Industrial Revolution, had witnessed an annual rate of growth of 0.1 per cent, but during the last century, the annual rate of growth has been approximately 3 per cent. This higher rate of growth had been the 'privilege' of the selected capitalist countries—the U.K., France, Germany, the U.S.A., Japan and Italy till 1917. Consequently the economic distance between these countries and those of the rest of the world increased to an unprecedented extent. The Soviet Revolution released social and technological forces that completed the Industrial Revolution in the shortest period of time, in an altogether different socio-economic framework. In the post-Second World War period, the attainment of a high rate of growth is being considered as the first pre-requisite of national survival. The example set by the centrally planned economies has tremendously impressed newly liberated underdeveloped countries of Asia and Africa. It is not an accident of economic history that the first country that evolved and implemented planning was itself an underdeveloped country. The history of planning is the history of the transformation of a backward country, through extensive industrialisation and utilisation of modern techniques on an unprecedented scale, into a highly industrialised country in a short span of time. From this experience we may generalize as follows : *the more backward an economy, the greater the need for planning.* It ensures an increased rate of development, and guarantees the swiftest annihilation of economic disparities between nations. Small wonder, therefore, that those countries which won their independence in the post-Second World War period have a preference for planning, burdened as they are by a predominance of agricultural pursuits within the framework of outmoded land tenures, a scarcity of capital resources and extensive operation of usurious capital, low productivity, low income, high mortality, high illiteracy, dominance of foreign capital in the tiny industrialized sector, lack of a diversified economy, outmoded socio-religious beliefs, and having traits of a "pluralistic" society. They are following a programme of economic development which is not pioneered by individual entrepreneurs, but by the national government. The governments are increasingly realising the value of attaining a high rate of growth. What significance the attainment of a higher rate of growth in the long-period, has for the poor countries in raising their standard of living, may be illustrated in the following : At 2 per cent per year per capita, output would grow 2.7 times in half a century and 7.2 times in one century : at 6 per cent, however, the growth would be 18 and 340 times respectively. This opens the possibilities of creating a world free from glaring economic and social disparities by the turn of the present century. This is possible only when the latest results of science and technology are used to ensure the realization of a higher rate of growth.

II: Economic Distance

The privileged nations, comprising only one-third of the world's population, command for themselves ample resources and enjoy all the benefits of science and technology. On the other hand, two-thirds of the world population inhabiting the underprivileged world continue to live in conditions of semistarvation, disease and squalor. If the present rates of population growths, without the warranted corresponding rates of economic development, continue into the future, one might anticipate a return to the age of famine and pestilence within a few decades. This ever-growing gap between the rich and the poor nations is one of the main sources of present international tensions.

The non-socialist world may broadly be classified under two groups of countries : (a) one group comprising some four hundred million people, whose average annual per capita income is about $ 1,000; and (*b*) a group which comprises one billion people but has an average annual per capita income of only $ 100. But within the two groups, no doubt, there are variations, for the United States' income is $ 2,000, the United Kingdom's $ 800, Israel's $ 400; and, on the other hand, there are countries like India with an income of only $ 50—$ 70. It is against the background of urgent need for development of the $ 100 countries that the 1960's have been treated as the decade of the beginning of peaceful competition in rates of social and material progress.

The necessity of such a peaceful competition is all the more urgent when one takes into account the grim facts associated with the low levels of living in the underdeveloped countries. Probably because of its explosive social consequences, an attempt has never been made by the international agencies like ILO, UNICEF, and UNESCO to express poverty in quantitatively comparable terms. But even a piecing together of stray information, about the situation during the middle of the fifties, presents a horrifying picture. The infant mortality rate per 1000 live births, in the underdeveloped countries, varies between 83 (Mexico)to 129 (Egypt); the average expectation of life at zero years is one of the lowest in India (32); and so is the case in respect of the available daily calories (1900) and the number of physicians available per ten thousand of population. The percentage of illiteracy is as high as 75 in Egypt and Ghana and 80 in India, Pakistan and Indonesia. The argument that the surface of the earth cannot provide food for a growing world population slurs over the fact that only 10 per cent of the land is presently cultivated and the use of existing technological possibilities can raise thisfi gure to 70 per cent.

It is against the background of using modern science and technology that one of the basic problems of the $ 100 countries is that it is not manpower but capital *including technical skill* that is short in supply and it is here that the $ 1000 countries have to play a vital role in assisting them. The crux of the issue is that $ 100 countries cannot develop without making heavy industry the hub of industrialization, it is here that the investment in education is investment in human capital which is scarer in these countries than fixed capital. Therefore, it is not primarily a question of choice of technique but of choosing the right type of economic organization, which will guarantee a higher rate of growth with the application of modern technology.

The argument that the new nations have to learn the application of science to their problems of what is already *well-known*, is only a half-truth. For realizing the full truth one has to recognise that the use of regional raw materials like cowdung and solar energy in India, or for fighting, the problems of the deserts in the Middle East and Africa, requires the development of new technology. Anybody who looks at the map of these countries will realize that desert and sea have existed as isolated neighbours for centuries. To break this isolation is to conquer the desert, and this is a problem which cannot be tackled with "known" technology. Similarly, through scientific surveys one has to discover not merely minerals and oil, but also such sources of food supply as have not been tapped so far.

III. Prospects for Future

The future of the underdeveloped and developing countries depends on the rate at which scientific and technical manpower is trained to harness their resources to ensure a higher rate of growth. The maximum application of the available and the latent knowledge of science and technology is, of course, a function of various factors, mainly economic, political and social. But given these factors, the application of science will immensely countribute to human happiness. Because ultimately the abundance, or otherwise, of the material goods and services needed for personal as well as social consumption depends on the use of known techniques and the discovery of new ones in increasing them. Food, clothing and housing are the three basic requirements of human existence. The application of science can appreciably raise the standards of living in the near future. Here are some examples:

AGRICULTURE

Extensive cultivation is a crude way of supplying food and raw materials. The application of modern science and technology can accelerate the pace of intensive cultivation through better breeding of crops and stocks of animals, eliminating pests and diseases and introducing fertilisers and irrigation. Further, it is within the realm of possibilities to produce and procure a substantial part of our food requirements through synthetic products.

INDUSTRY

Any type of industrial production can be made cheap if electricity can be made cheap. This is realizable if power is generated from atomic fission. Science holds out the promise of providing atomic energy as freely, and in as much abundance as water and air in half a century. The application of such technology can raise the industrial output on an unprecedented scale in the developing countries and raise their levels of living. With the availability of artificial fibre, it is no longer necessary to use land for producing cotton. The introduction of electronic automation promises not only cheaper industrial goods but more leisure to the workmen.

BUILDING

There are immense technological possibilities for using pressure, heat, vibration and pre-stressing of common mud and sand to replace the present methods of making hard blocks and structures through joining cement and sand. Similarly mechanization of building construction and pre-fabricated parts can quicken the speed of supplying housing to the people.

In the preceding paras, the problem of the application of knowledge to production—agricultural as well as industrial—has been raised. This takes us to the wider issue of the role of education in economic development. Both Marx and Gandhi have emphasised the method of knowing through doing. But our immediate interest is to invite the attention of this group to the unprecedented opportunities that planned economic development in underdeveloped countries unfolds for taking knowledge to the farms and the factories. In this task the Universities and Research Institutes cannot be allowed to continue to live like Ostriches. In the centrally planned economies, the Academies of Sciences, with their branches in the regions, provide a comprehensive machinery for applied research in various disciplines. In the developing countries, increase in per acre yield, gap between agricultural and industrial growth, role of agricultural investment, process of development, agrarian and industrial problems, village councils, trade unions, rationalization, productivity, utilization of surplus labour, wage-structure, wage policy, methods of wage payments, application of work-day units, working out of norms, problems of state trading, impact of mechanization, price-policy, methods and levels of popular participation, utilization of leisure, bureaucracy under planning, emerging social relations and social institutions are some of the problems on which researches can neither be carried on in ivory towers, nor the results of researches on them can be left unintegrated into the economy. These examples from the fields of Social Sciences, are given to illustrate the view that Science has a most crucial role to play in economic development and cannot be left unplanned.

Therefore, the development of science and technology in maximising human welfare and happiness may be considered with reference to : (a) expanding and modernizing productive capacity with a view to increasing the production of mass consumption goods and services ; (b) development of synthetic and other artificial materials to economise and /or substitute the natural raw materials, e.g., coal, cotton etc. (c) development of atomic energy, electronics, etc. to increase productive efficiency; (d) reduction of working day and providing more leisure for the development of man's personality; (e) promotion of housing construction with more amenities, both in urban and rural areas and (f) improving and expanding medical and public health facilities.

IV. Organization

At the very outset we have indicated that the development of Science is an aspect of Man's War against Nature. In this process, Physical, Biological, Technological and Social Sciences have grown. Thus, science is a great human institution. It needs to be socialized rather than left at the mercy of anti-social elements. In the market economic development of science and technology has been tied to the profit-maximization techniques and/or preparing for the Cold War. The results of Science should be an asset to humanity rather than a curse—specially in the atomic age. This poses the problem of organizing researches in science and technology with a view to maximizing human welfare. The Scientists, when science is capable of destroying the human race, cannot afford to be neutral about the ends to which the results of scientific research are put. Science research requires reason and freedom; but both these are subordinated to the needs of the research sponsoring authorities. Therefore, scientists' 'vested interests' demand that they should work for the creation of a social system in which they have a share in the ownership and management in the means of research.

Here comes the role of planning science for social welfare. The needs of human beings must be accurately forecast and provision made for their satisfaction. Such a planning, specially when concerns scientific potentialities must be necessarily on an international scale because of increasing interdependence of nations. Scientists would like a world wherein countries cooperate in a planned way to secure the best environment for all human beings and give them a chance of making the most of their abilities. The process of competition to cooperation, internally as well as internationally, can become the school to prepare mankind for a more consciously planned and beneficiently directed society.

This Paper was presented at the Symposium on 'Problems of Advancement of Science in Developing Countries' held in Budapest during Sept. 20-23, 1965.

SCIENCE IN PARLIAMENT

Manufacture of Magnesium

At the instance of the Madras Government, the Central Electro-Chemical Research Institute, Karaikudi has undertaken pilot plant trials for the production of magnesium metal from Salem magnesite.

Answering a question tabled by Shri Uma Nath in the Lok Sabha on November 10, 1965, Shri M. C. Chagla, Union Minister for Education said the object of these trials was to standardise conditions for the production of 12 kg. of magnesium metal per day of 24 hours. The work was in progress and the process had not yet been perfected.

Research on Creating Life

In reply to a question tabled by Shri H. V. Kamath on November, 17, 1965, Dr. (Mrs.) T.S. Soundaram Ramchandran, Deputy Minister for Education stated in the Lok Sabha that Prof. O. N. Parti and Shri H. D. Pathak at Nainital and Dr. Krishna Bahadur and his wife Dr. S. Ranganayaki at Allahabad aided by their research scholars, were reported to have been able to prepare by a photo-chemical process cell-size units (0.5 to 2.5 microns) which exhibit the biological characteristics of growth multiplication and metabolic activity.

The Minister said the Government was not aware if their claim had yet been accepted by the scientific world.

Research on Vitamin 'A'

Shri M. C. Chagla, Union Minister for Education told the Lok Sabha on November 17, 1965 that research work on Vitamin A metabolism was started in 1953 in the Department of Bio-Chemistry of the Indian Institute of Sciences, Bangalore. The work had so far been done only with laboratory animals.

Shri Chagla was replying to a question tabled by Shri Ram Harak Yadav. He said that since 1950 the Institute had been receiving suppoit of the Indian Council of Medical Research for this research project. It was now proposed to continue this work as a scheme under PL-480 programme for a period of three years. The grant of Rs. 2,13,490 had been approved under PL-480 scheme for the entire period. As soon as this grant was received, the Indian Council of Medical Research would withdraw their support.

Shortage of Science Teachers

Some of the steps taken so far to meet the shortage of science teachers in the country had been disclosed in the Lok Sabha on November 17, 1965 by Shri M. C. Chagla, Union Minister foi Education.

Replying to a question tabled by Shri Bhanu Prakash Singh and Shri Yashpal Singh, Shri Chagla said that training courses for science teachers were being given in the four Regional Colleges of Education, established by the National Council of Educational Research & Training. Also under the crash programme for the improvement of secondary education, the Government of India had placed funds at the disposal of the State Governments for organising special courses for graduate science teachers already working in schools to meet the shortage of post-graduate science teachers.

Shri Chagla further informed the Lok Sabha that an Expert Committee had been set up in

National Council of Educational Research & Training to formulate the detailed scheme for suggesting special short term and long-term measures to increase the supply of science teachers. Further action would be taken in the light of the suggestions to be made by the Committee.

Scientific Workers Conference in Budapest

The Union Minister for Education, Shri M. C. Chagla, stated in the Lok Sabha on December 1, 1965 that Association of Scientific Workers of India participated in the conference of the World Federation of Scientific Workers held in September 1965 in Budapest. He was replying to a question tabled by six members of the Lok Sabha, namely : Shri P. R. Chakravorti, Shri P. C. Borooah, Shri Onkar Lal Berwa, Shri Hukam Chand Kachavaiya, Shri Bade and Shri Yudhvir Singh. The Conference, he said, was attended by over 200 delegates from more than 50 countries from Asia, Africa, Latin America and Europe. Observers from Unesco and WHO were also present. The Conference discussed problems of advancement of science and technology in developing countries and the role of international scientific cooperation. It also discussed problem of war danger, disarmament and other allied problems.

Shri Chagla disclosed that the Chinese delegates attempted to malign India with wild charges. The positive approach of the Indian delegation had the desired effect on the audience. The behaviour of the Chinese was resented by all delegations and the entire speech of the Chinese delegate was expunged from the proceedings.

Shri Chagla added that the Chairman, Prof. Powell of the General Assembly condemned the behaviour of the Chinese as uncivilised and said that the Chinese by their action had earned the contempt of the scientific community. He ordered that any further violation of the rulings of the Chair will be followed by immediate suspension of the meeting and switching off the electric current in the Hall. This was done thrice in one day amidst shouts of "Shame", "Chinese go Home" and "Boos" when the Chinese speakers tried to act against the Chair's decisions.

Colouring of Vanaspati not Practicable

It has not been a success so far to colour vegetable ghee to make it distinct from pure ghee.

This was stated in the Rajya Sabha on November 15, 1965 by the Food Minister, Mr. C. Subramaniam, who said that the Committee of Scientists appointed by his Ministry to inquire into the possibility of colouring vanaspati had submitted its report. The Committee had expressed its inability to find out a suitable colour and had arrived at the conclusion that colouring of vanaspati was neither practicable nor desirable.

Mr. Subramaniam said that the Committee had said in its report that latent colorisation of vanaspati with seasame oil currently in force, along with a more rigorous enforcement of the anti-adulteration laws, and the marketing of ghee in small containers, preferably under an AGMARK seal, should serve the purpose.

The Minister explained that a colour of normal strength tended to fade away while that of unusual strength produced the toxic effect.

Members, however, were surprised that the committee could reach this conclusion only after research and experimentation for five years. Mr. Chordia asked the Minister if he could declare that any other scientist who could find a suitable colour would be generously rewarded. The Minister replied that he was willing to make such an offer.

Mr. C. D. Pande, however, said that since the number of those who consumed pure ghee was much less than those who consumed vanaspati ghee, the Minister should give up the efforts for colouring vanaspati.

Agreeing with Mr. Pande, the Minister said that there was a wrong notion in this country that ghee was the only energy food. He was inclined to believe that since ghee contained a lot of fat it was to some extent injurious to health and therefore vansapsti was preferable.

Mr. Sri Rama Reddy, however, was of the view that the problem was not of the adulteration of pure ghee but that of vanaspati ghee. He said that there was considerable adulteration of vanaspati ghee and this endangered public health.

Mr. Subramaniam replied that there was adulteration in every field even in the field of thought and ideas.

National Laboratories and Defence Effort

In reply to a question tabled by five M.Ps. namely, Sarvashri D. C. Sharma, P. R. Chakraverti, P. C. Borooah, Heda and Yashpal Singh in Lok Sabha on November 3, 1965, the Union Minister for Education, Shri M. C. Chagla confirmed that the national laboratories were being geared up to meet the needs of defence. A Steering Committee with representatives of Defence, Technical Development and Supply was formed in 1962 to study Defence problems, identify them and to take further action to find solutions. This Committee is assisted by a Defence Coordination Unit, which is working in close collaboration with Defence and has assigned a large number of projects to the national laboratories which have either been completed or are in different stages of development. Supplies are being made to Defence in respect of 29 items which are being produced in pilot plants in the various laboratories/Institutes. A number of new developmental projects have been recently referred to the national laboratories for examining the feasibility of taking them up.

(*Contd. from Page 3*)

centralised coordinating agency. Autonomy in the universities should not become an excuse for disallowing a look into their unhealthy state of affairs but should be the protector of proud traditions of academic freedom and right of independent thinking and expression. Such traditions most of the Indian universities have yet to build up.

A grave responsibility lies on the shoulders of those who run the affairs of education and technical training in this country. The educational system should have the services of men of ability, energy and devotion who should be entrusted the task of purifying and modernising the present redundant educational set up and structure in the country.

C. E. C. MEETING

A meeting of the CEC of Association of Scientific Workers of India was held on 21.11.65 in New Delhi.

The following were present :

1. Dr. N. P. Gupta (in Chair)
2. Shri A. Rahman
3. Shri Baldev Singh
4. Dr. V. S. Nair
5. Shri S. Dutta
6. Shri J. M. Dutta
7. Dr. S. P. Popli
8. Shri K. Kashyapa
9. Shri N. V. Sripathy
10. Shri G. V. Subramanya
11. Shri A. K. Lahiri
12. Shri Mohan Rai
13. Shri V. Narasimhachar
14. Shri Pathak
15. Shri R. L. Seth
16. Shri D. Kanungo
17. Shri M. G. Ramdos Menon
18. Dr. S. Husain Zaheer
19. Shri K. S. M. Sastry
20. Shri S. Bhattacharji
21. Shri Yad Hasan
22. Shri R. N. Nigam
23. Dr. (Mrs.) Sultana Z. Ali
24. Shri Y. R. Chadha
25. Shri S. P. Gujral
26. Dr. S. K. Roy.

Reports were presented by General Secretary (Orgn.), General Secretary (Publication) General Secretary (International Relations) and the Treasurer. It was felt that some of the resolutions adopted in the last annual meeting of the Council were not followed up. The reasons were discussed and it was felt that the resolutions may be followed up soon with appropriate authorities. An opinion was expressed that ASWI should adopt only such resolutions which it can follow up. It was suggested that Branch Secretaries should take up the responsibility to explain to its members the extent of redress the ASWI can achieve for them.

The question of raising the membership subscription received attention. A rise in membership subscription was necessary to achieve self-sufficiency. The meeting recommended that this might be re-examined further and discussed in the Council. The possibility of having a separate subscription for Vijnan Karmee was also mentioned in this connection.

The question of recognition of ASWI was discussed. In this connection the question of forming some kind of a federation of CSIR Branches was raised.

The meeting noted, with satisfaction, the participation of ASWI delegates in the 8th General Assembly of World Federation and the Symposium held in Budapest in September 1965 under the auspices of the World Federation.

The CEC adopted resolutions dealing with :

(*i*) Study leave and study loan

(*ii*) Affiliation and recognition of ASWI

(*iii*) Pay scale of STA and SSA and merit promotion

(*iv*) Membership drive

(*v*) Function of the Bureau

(*vi*) National Emergency

and directed the Bureau to take suitable follow up action soon. It also considered the resolution on proliferation of nuclear weapons and reaffirmed its faith in the resolution adopted in the last meeting of the Council. It was decided that a special issue of V.K. may be brought out on this issue.

The CEC tentatively decided to hold the next meeting of the Council in March 1966 in any of the Branches. However, the final date was to be decided after the dates of the CAAUST Symposium had been fixed. Dr. S. Husain Zaheer, who was present in the meeting, was specially requested to address the members. He expressed his sense of satisfaction at the growing activity of the Association. He however desired that efforts should be made to take the activity of the Association outside CSIR. He commended the work done by International Relations Committee of ASWI. He told that the suggestions regarding the promotion of scientists on merit basis had already been taken up by CSIR and steps were being taken to implement them.

Report of General Secretary (Organisation)

In presenting the report, I would like to review the working of ASWI during the last 8 months since the last meeting of the C.E.C. on 14th March, 1965.

1. **Bureau**

1.1. The Council of ASWI, decided to appoint a Bureau of the CEC to act on behalf of the CEC. It was also decided that proceedings of the Bureau should be circulated to the members of CEC soon after the meeting. I have pleassure to report that the Bureau had been meeting regularly since then, the first meeting being held on 5th April, 1965. The Bureau has so far met 14 times including one emergency meeting. The attendance in the meetings of the Bureau has been satisfactory, the outstation members also found it convenient to attend the meeting at least once. An outstation member of CEC also attended one meeting of the Bureau while he happened to be in Delhi.

1.2. The Bureau considered the resolutions adopted in the Annual Meeting of the Council and the action to be taken on them. It was decided that some of the resolutions may be pursued with the proper authorities and this has been done though belatedly. The Bureau felt that the language issue may be taken up in a special issue of V.K. Unfortunately, much headway could not be made on the resolutions on service conditions and the position may be reviewed in this meeting. The subject matter of some of the resolutions was opened in the columns of V.K. for discussion.

1.3. The Bureau also attended to some of the grievances of individual members of Branches which came to its notice. In most of the cases, the members concerned were employees of CSIR and personal contact was established with the authority concerned to seek a redress.

1.4. The attempt of the Bureau to get the NPL Staff Association affiliated with ASWI has not been successful yet.

1.5. The Bureau also decided that some of the letters, reports, resolutions etc. received from Branches, containing matters of general or topical interest, may be published in the "discussion forum" of V.K. to elicit public opinion on such matters.

2. **Membership and Recognition**

The question of recognition of the ASWI as the representative or trade union organization of scientific workers of India is closely associated with the strength of the Association. At present the bulk of the membership is from CSIR organizations. As a first step to secure recognition, the Bureau felt that attempt should be made to seek the recognition of C.S.I.R. In a recent meeting it was felt that the effective way to do this may be to form a kind of a Federation of CSIR Scientific Workers Association. This idea may form the subject matter of discussion in Branches in CSIR organizations.

However, relevant to this it is necessary that ASWI should have a wide membership of a truely representative character. Hence the Bureau feels that an all out All India membership drive should be undertaken. The Bureau decided to bring out a small booklet describing the aims, objecttives and activities of ASWI for circulation. This is under preparation. It is expected that the Branches will do all they can, to help the central office in this. Any suggestion in this respect is welcome.

3. **Office**

The members of CEC will be pleased to know that it has been possible to rent a 4-roomed suite at 28/17, East Patel Nagar to house the office of the Association. Necessary office staff has been appointed and requisite furniture have been purchased or procured on rental basis. Members of the Bureau attend the office on a schedule adopted at the Bureau to look after the working. The ASWI is also negotiating with the NDMC for allocation of a flat (on rental basis) in the new super market being constructed in Connaught Place.

4. **Publication (Vijnan Karmee)**

The Vijnan Karmee is being published regularly and a report of the General Secretary (Publication) will follow. The copies of V. K. were earlier being sent to the Secretaries of the Branches in bulk for distribution to members. A suggestion was made in the last meeting of the Council that V. K. may be sent to individual members. The Bureau considered this question and decided to send V. K. individually to members of good standing. This is being done now. Some of the branches and individual members, however, correctly pointed out that this is a more expensive procedure. The ASWI is negotiating with the Post and Telegraphs Dept. for registration as a magazine for purposes of posting at a concessional rate.

5. **Finance**

5.1. A statement of actual expenditure during the current year upto 30-9-65 is appended. I would like to mention in this connection that the expenditure on publication of V. K. is increasing heavily adding to deficit. The expenditure on other items has also increased tremendously. The income of the Association has not increased in a proportionate manner. The Bureau is trying to increase the advertisement revenue and I would invite all help and assistance from the Branches in this respect. I appeal that each Branch may take the responsibility of securing at least one page advertisement for V. K.

The Bureau has decided to raise the fee for Institutional subscribers of V.K. Cooperation of Branches in enlisting Subscribers is also solicited. Last but not the least, I would suggest that the CEC considers the question of raising the membership fee. The annual fee of Rs. 5/- per year was fixed some 19 years ago and it deserves a serious reconsideration.

Any other effort of raising funds for the Association by way of donation etc. should also receive consideration.

5.2. The Govt. of India have been pleased to sanction a grant of Rs. 4 lakhs for organising the CAAUST Symposium to be held in the winter of 1965-66. We have not yet received the Govt. of India sanction of the grant-in-aid for the year 1965-66 for publication of V. K. but are negotiating on it.

5.3. The Council of ASWI in its meeting held in March 1965 appointed M/s K. C. Gupta & Co. as Auditors of the Association for auditing the accounts for the year ending 31-3-65 and recommended that the remuneration to be paid to them may be negotiated. M/s. K. C. Gupta & Co. have very kindly agreed to undertake the work on a remuneration of Rs. 600/-. Considering the prevailing rate in Delhi and the volume of work involved, the Bureau suggests that CEC may kindly agree to this remuneration.

6. **International activity**

6.1. The Bureau decided to participate in the 8th General Assembly of the World Federation of Scientific Workers and the Symposium under the auspices of WF held in Sept. 1965 at Budapest, Hungary. Four of our members attended the Assembly and the Symposium. A large number of papers were contributed by our members.

Detailed reports will follow.

6.2. As you are no doubt aware the ASWI will be the host to the International Symposium on "Collaboration between countries of Africa and Asia for utilization of Science and Technology". The first meeting of the Preparatory Committee was held in April 1965 at Cairo. An Organising Committee with Dr. Zakir Hussain, Vice-President of India as Chairman has been formed. A number of scientists in India have very kindly agreed to be members of the Organizing Committee.

7. **The ASWI and the National Emergency**

The Bureau considered the special situation created in the country with the aggression on Indian Borders by Pakistan and pledged the full support of the Association to the Government of India. The Bureau also felt that members of the Association should fully participate in all civil defence measures organised by the Govt. A resolution urging the members to participate in civil defence was circulated to Branches.

8. Before I conclude this small report I would record my grateful thanks to the members of the Bureau, CEC and Branches for their helpful cooperation.

Sd/- S. K. Roy

Report of General Secretary (Publications)

Since March 1965, we have been able to bring out 6 issues of Vijnan Karmee as per statement below :

	Number of copies printed.
March-April '65 issue	2000
May '65 issue	1800
June '65 issue	1800
July '65 issue	1600
August '65 issue	1700
September '65 issue	1700

The number of copies printed was reduced as a good number of copies used to be left over after distribution.

The change in design of the cover has been introduced since June '65 issue of Vijnan Karmee . The copies of each issue are also being sent directly to the members at their individual addresses.

A new feature 'Frankly Speaking' has been introduced which is mainly desired to be a topic for discussion viz. 'Tailored advertisements' which appeared in June 1965 issue. This also deals with the problems of scientific personnel viz. 'Forwarding of applications' etc. The activities of the Bureau of C.E.C. and Branches are being regularly included in the Journal.

A concerted effort towards the procuring of the advertisement for V. K. is being made and we are glad to report that uptil now, space has been booked for advertisement by eleven parties which will bring in a revenue of about Rs. 4500/- We have six institutional members and efforts are also being made to enrol other members for the year 1966.

The expenses incurred on bringing out the six issues of Vijnan Karmee (March to September '65 issues) and despatching the copies to the members have been of the order of about Rs. 10,000.

It has been decided that if the authors wish, the articles and letters published in Vijnan Karmee may be paid for—Articles at the rate of Rs. 25/- per page subject to a maximum of Rs. 100/- per contribution and letters at the rate of Rs. 15/- per page subject to a maximum of Rs. 25/- per letter.

It has been planned to bring out December 1965 issue of V.K. a special issue dealing with an important issue "India and the Atom Bomb —Should India manufacture atom bomb or not?".

It may be reported that Dr. D. S. Kothari, Dr. D. M. Bose and Dr. S. Bhagwantam have expressed their inability to continue on the Editorial & Advisory Board of V. K. and their resignations have since been accepted.

The work of publishing the proceedings of the Symposium on "Science and the Nation" was entrusted to Thorne's Publications, Calcutta. The manuscript of the proceedings, after processing and editing by Shri Y. R. Chadha, were despatched to the publishers in Nov./Dec. 1964. The publishers had promised to bring out the first volume by April or May, 1965. The first batch of the proofs was received in February, but after that there was a gap of nearly six months. It was only after persistently pursuing the matter that further proofs started coming at regular intervals. By mid-October, the complete proofs for volume I were received and sent back duly scrutinised. The publishers have been requested to expedite the work. The proceedings would be brought out in three volumes.

Sd/- Baldev Singh

Detailed statement showing actual income and expenditure from 1-4-65 to 30-9-65

INCOME	Rs.	EXPENDITURE	Rs.
1. Centres Share of contribution received at Branches	218.35	1. Establishment Salary and Wages of staff	1529.76
2. Advertisement Revenue	648.25	2. Printing charges for Vijnan Karmee	6315.34
3. Sale Proceeds of Vijnan Karmee	93.13	3. Postage and Telegrams (including despatch of Vijnan Karmee)	1273.48
4. Affiliation fee received	35.00		
	994.73		9118.58
Excess over income	8123.85		
	9118.58		

Sd/- J. M. Dutta
HON. TREASURER

Report on Budapest Symposium on Problems of advancement of science in developing countries and the role of international collaboration

Origin

It has been customary for the WFSW to sponsor an international symposium on the occasion of the meetings of its General Assembly which meets every 2-3 years. A symposium was therefore proposed soon after the conclusion of the Seventh General Assembly meeting at Moscow in 1962.

Two topics were proposed; one on problems of advancement of science in developing countries and the other on dissemination of scientific knowledge. Two commissions were set up for preparing detailed papers so that the subject could be finally chosen out of the two at an earlier date.

The Bureau of the World Federation could not reach unanimity on the choice of the topic. The matter was referred to all affiliated organisations and it was only in 1964, that the topic of the symposium could be decided by majority vote. The Chinese voted for the dissemination of scientific knowledge as the topic but this did not receive much support.

Considerable discussion also took place on the Venue for holding the symposium.. In 1963, ASWI offered to be the host for both the symposium and the Assembly meetings. The World Federation Bureau did not accept this offer largely because of Chinese opposition. The ASWI again repeated the offer in 1964. This was discussed in the meetings of the E.C. held at Bucharest. Once again the Indian offer was opposed by Chinese and nearly all West European representatives. The ASWI therefore withdrew the offer. Budapest was finally chosen as the Venue.

Preparations

A preparatory Committee was set up by the WFSW. Little progress could be made in this regard until 1964. One of the main reasons was the Chinese attempt to get the symposium organised according to their approach to world affairs. Repeatedly in various meetings, the Chinese argued that the symposium should concentrate on "fight against U.S. imperialism" which combined with "self reliance" was the only way to advance science in developing countries. Long letters and documents were submitted by the Chinese on these matters. But the Chinese view points were rejected by the majority.

The Chinese then took up the question of participation by U.N. observers in the symposium. The WFSW is affiliated to UNESCO —and has consultant status B. Co-operation with UNESCO is provided in the constitution of the World Federation. In the past, observers from U. N. organisations have always been invited to WF symposium.

UNESCO has paid three thousand dollars for the symposium. The Chinese opposition to work in cooperation with UNESCO was also turned down.

In January 1965, the Preparatory Committee met at Budapest. The Chinese did not attend and ASWI was invited for the first time. This meeting worked out detailed proposals for organising the symposium. Two delegations were set up to visit East African and West African countries to mobilise support for the symposium and contact scientists personally. Despite difficulties, ASWI offered full support to the symposium.

The Symposium

To the Budapest Symposium came over 165 participants from over 50 countries. In addition, 46 scientists were from Hungary itself. Sixty four papers were submitted. The symposium had three plenary sessions and three sections. Two sections had to be run simultaneously. Translation facilities were available in six languages.

There were 8 papers in the inaugural plenary session. It was initiated by Prof. Bognon of Hungary who spoke on priorities in scientific research and the application of science to economic development. Other speakers were Prof. Bernal from U. K., Dr. Zaheer from India and others from Viet Nam, Cuba, Ghana, USSR and China.

The final plenary session heard reports of the work done in sections.

Section I was largely devoted to science, planning and economic development. Nearly 30 papers were presented in this group.

Five papers dealt with economic planning and effectiveness and organisations of scientific research. Many reports showed that under staffing of science institutions required to be overcome by greater scientific cooperations. A paper from Netherlands suggested that modern technology need not be introduced in developing countries, because they needed development by degrees and not industrialization. An East German paper, on the other hand suggested that modern technology should go to developing countries immediately. A lively discussion took place. An Indian delegate criticised a paper from Mali for being too general. In turn this paper was defended by a delegate from USSR.

Three papers discussed scientific research and planning. Two of them were from India and one from Rumania. All three reports stressed planning so that research could serve the people. During the discussion a suggestion was made that WF should publish a compendium of papers on planning as carried out by USSR, England, France, Netherlands etc.

Problems of scientific development in different continents were then presented. Three papers from Nigeria and Senegal evoked some discussion. More took place on papers from Ghana, Korea, and Monogolia. Four papers came from Peru, Chile and Argentina which described conditions in Latin America. Seven reports dealt with scientific aid and cooperation but from very divergent angles. Three came from India, China (1) Czechoslovakia (1) and one each from Viet Nam, Indonesia and Albania. Dissertations stressed the needs for quality in scientific work, the responsibility of both socialist and imperialist countries to provide aid and a better organisation to supply technical equipment.

Section II. In section two, over 25 papers were presented. These dealt with problems of industrialization, agriculture, health and other applied aspects.

One paper each from Tanzania, Senegal, Viet Nam, GDR and Madagascar, and three papers from India dealt with problems of health and drugs in these countries. Proteins supplies for mankind were discussed in papers from India and Czechoslovakia. Lively discussions took place on this question.

Problems of agriculture were presented by papers from Nigeria, CSSR, GDR, India, Viet Nam and Jamaica. The notes on machines, fertilizers, new techniques, social attitudes were discussed.

National resources and their scientific exploitation, forestry, energy resources and water resources were discussed in a series of papers from France, India, Poland, USSR, Hungary and other countries.

Industrialisation and urbanisation were taken up by papers from CSSR, Mali, and China.

Section III : Twenty four contributions in this section dealt with three problems of scientific training.

—System and methods of training.
—Role of international cooperation.
—Migration of scientists.

Papers from Peru, Mongolia, East Africa, Cuba, USSR, Cameron, UAR, North Korea, China, Albania and Indonesia described experiences of own countries. Two papers from Bulgaria and CSSR discussed training of personnel for developing countries.

Speakers from U.K., Australia and UAR discussed the note of international collaboration, papers on scientific information and migration of scientists came from India and China and other Latin American countries.

The Symposium was marred by the Chinese attempt to attack India and USSR right in the inaugural plenary session. This was generally resented. Prof. Powell as Chairman, sharply rebuked the Chinese and dissociated himself and the World Federation from Chinese remarks. The Indian and Soviet delegations gave suitable and dignified replies and refused to fall a prey to Chinese provocations. This attitude was widely appreciated and supported by participants.

One morning was devoted to Viet Nam question as an informal discussion. A film was shown and signatures collected on a memorandum.

Report on 8th General Assembly of World Federation

It may be recalled that the World Federation of Scientific Workers (WFSW) was founded in 1946 to bring together scientists and scientists organisations from different countries. It was formed to promote the interests of scientists and the use of science for human welfare. The WFSW has consultant status B with Unesco. The Association of Scientific Workers of India (ASWI) was formed in 1947 with Jawaharlal Nehru as its Founder President. The ASWI has been affiliated to WFSW from its very beginning. The World Federation holds its General Assembly meetings every 2-3 years and the meetings of its Executive and Bureau in between.

The 8th General Assembly of WFSW was held from September 24 to 26, 1965. Of about 20 items on the agenda, discussion centred round the report of the Secretary General, scientists and disarmament and aid to Viet Nam.

Speaking during the general discussion, Chou-Pei-Yuan from China read out his political thesis. In this document he repeated his catch phrases like "U.S. Imperialism", "Soviet revisionism", "Indian aggression and expansionism" and "self reliance" etc.

Many delegates raised points of order but the Chinese started shouting. The Chairman declared that he had lost control of the meetings. But Chou went on for 55 minutes against the allotted time of 15 minutes.

The misbehaviour by the Chinese was resented by all delegations. Chairman Powell at first tried to pass over the incident but later had to issue a statement under intense pressure and lobbying; Powell expunged Chou's entire speech from the proceedings and reiterated that the Chinese by their uncivilised behaviour had brought themselves in contempt at the Assembly. He praised the restraint shown by the Indian and Soviet delegations in the face of severe provocations. He further ordered that any further violations of the rulings of the Chair will be followed by immediate suspension of the meeting and by switching off the electric current in the Hall. In one day this had to be done three times amidst shouts of "shame" "Chinese go home" and "Boos" when the Chinese speakers tried to act against the Chair's decisions.

There were six commissions set up by the General Assembly where prolonged discussions took place on resolutions. There was little controversy in the commissions on

(*i*) Economic conditions of scientists

(*ii*) Finance, Constitution and Regional Centres

(*iii*) Publications

and the reports and resolutions were adopted more or less unanimously. A new Regional Centre of the World Federation was announced at Cairo. This Centre would look after the World Federation activities in Africa. It may be recalled that Regional Centres of the WFSW exist in India and China and Prague (Czechoslovakia).

The recommendations of the Commission of "International Co-operation" were also largely non-controversial. An Albanian alternative draft was rejected.

The Commission on "War danger, disarmament and allied problems" evoked intense discussions both in the commission meetings and in the Assembly. Five drafts were presented. Finally a sub-committee drafted a resolution deleting all reference to U.S. Imperialism. Several Indian amendments were also incorporated (appreciating the role of countries which have refused to make atomic weapons and welcoming the ceasefire between India and Pakistan). This resolution was bitterly opposed by the Chinese both in the Commission and in the Assembly, but the Assembly passed it by an overwhelming majority.

During the debate on this topic, an Indian delegate made an impassioned speech drawing the attention of the house to the new emerging imperialism of Himalayan dimensions. He referred to the explosion of atomic bombs on Asian soil against the wishes of the people of the Asia and the World. He referred to the new threat to peace from countries who gave ultimatums for the non return of cows and sheep allegedly stolen across the border. He ridiculed the "anti-imperialist" pose of some because they gave full support to a member of Seato and Cento in its aggressions against a peaceful non-aligned neighbour. He called the Chinese pose a sham and a manoeuvre to hoodwink the people of Asia and the World to carry out its own nefarious designs against other countries.

A long discussion also took place on the recommendations of the commission on practical steps to aid Viet Nam. Apart from ideological support, there was little of practical value in the resolution. Some participants even frankly commented that many delegates were only keen to get their ideological position reflected in the resolution on Viet Nam. The Indian Delegation commenting stated that he agreed with demand for stoppage of bombings of North Viet Nam, withdrawal of all foreign troops and peace and freedom for Vietnamese people. On the resolution itself, the Indian, British and the French delegations abstained.

The elections of the Executive Council of the WFSW were largely uncontested except for the posts of Vice Presidents and Individual Members. Dr. S. H. Zaheer from India was elected as one of the Vice Presidents. The Chinese nominee for Vice-Presidentship got the least number of votes among those elected. The Chinese nominee was voted out among the individual members. Dr. N.P. Gupta was elected as a regional member of the E.C.

Sharp exchanges between the Chinese on one side and nearly all others against them went on in the meetings of the Bureau and the Executive Council of the WFSW. After the elections the new E.C. discussed the question of expulsion of those who by their misbehaviour were trying to wreck the WFSW. It was decided to circulate the incidents of Budapest meetings and seek advice and assurances from all affiliated organisations. This was supported by all the members. The Chinese did not attend this meeting.

The Indian delegation carried out extensive informal discussions in an organised manner. The Indian view point on Kashmir and aggression by Pakistan and threats by the Chinese were explained at these meets. The Indian delegation was thus able to meet at informally organised gatherings, nearly all the European, African and Asian delegations. A large number of useful contacts were established with African and Asian Scientists for their participation in the forthcoming Afro-Asian Symposium in New Delhi in early 1966.

The Chinese were isolated at Budapest. Even North Korean Vietnamese and Indonesians did not seem to support them in their aggressiveness. The Chinese did not receive support from the British Scientists this time. Angered, the Chinese even cancelled the proposed visit of their delegation to U.K. immediately after the symposium.

Report of Commission II on Economic Condition of Scientists

The Commission was attended by delegates from France, Poland, Czechoslovakia, the USSR, Bulgaria, Mongolia and Great Britain.

The Commission has considered the progress of the outstanding questions arising from decisions of earlier assemblies and recommends:

(*a*) on the survey on the employment of technicians as assistants to Scientists in Universities, Colleges of Technology and Research Institutions, that an appeal be sent to all affiliated organisations who have not replied to the second questionnaire circulated on 26th October, 1964 to reply not later than 31st December, 1965 and that a report be published as soon as possible in 1965 on the results of the survey:

(*b*) On the conditions under which scientists and technologists are seconded to work in other countries. The Commission noted with appreciation the article by Mr. Cope which is published in Scientific World, 1965, No. 3, in which this question is discussed and in which the specific problems are described. In this article it is stated that an official request for information is being made by the W.F.S.W. to its member organisations, and the Commission recommends both that the request be made as quickly as possible and that the affiliated organizations respond to the request without unnecessary delay.

The Commission wishes also to submit this Resolution to the Assembly, that this Assembly of the W.F.S.W. seeks the Executive Council.

To organise a systematic study of the economic and social position of scientific workers and in this connection :

(*a*) To prepare and distribute to affiliated organisations a questionnaire on the problems of salaries, of pensions and other forms of social security, of other conditions of employment, of professional rights and of safety at work:

(*b*) To obtain this information from affiliated organisations, corresponding members and organisations not affiliated to the Federation directly or through Regional Centres;

(*c*) To publish periodically and at least once a year a summary of the information collected and summarized as the basis for the preparation of an international convention on the conditions of work and the rights of scientific workers and thus to assist scientific workers in many countries in their trade-union work;

(*d*) In particular, the Executive Council is asked to consider the question of the protection of scientific workers from hazards arising from the use of toxic substances in scientific work and on the protection of other workers from hazards in the use of such substances in productive and other processes.

Report of Commission VI-International Scientific Cooperation

The importance and the need for international scientific cooperation in modern times cannot be over-emphasized. The dependence of modern life, in all its aspects, on sciences and technology, the great expenditure needed for the progress of science and the grave consequences of lack of scientific development in certain countries—all these and other factors call for an over increasing cooperation between the scientists of different countries. International collaboration in science should always be guided to promote the strengthening of internal scientific development within the developing countries to eliminate political subjugation and neo-colonialist exploitation. The General Assembly feels that International cooperation if properly concluded, can fulfil the following aims:-

(*a*) Training of scientific and technical cadres, particularly in, and for developing countries.

(*b*) Dissemination of scientific knowledge through exchange of scientific material, as periodicals, books, films, etc. and personal contacts and scientific meetings.

(*c*) Exchange of scientific and technical personnel and experiences between different countries.

(*d*) Solving some of the problems of the developing countries.

(*e*) Facilitating the solution of problems common to several countries by mutual scientific cooperation.

(*f*) Development of science itself.

Taking into account all these factors and aims of the WFSW, the General Assembly resolves:

The E. O. will urge all WFSW Member organizations to give their fundamental attention to the problems of the cooperation with developing countries, to submit to the E.O. their experience from cooperation with these countries in the advancement of science and in the solution of scientific problems and to place ideas before the E.C. which would improve the assistance of WFSW to developing countries, to put questions and requests for advice of how best to apply the most effective international cooperation in various questions. It is recommended that during the next two years all Member organisations evaluate in the most appropriate form their own experiences from co-operation with developing countries and accumulate ideas for its future development.

The E. C. will create a permanent study group which will continuously consider questions of collaboration with developing countries, accumulate ideas and experience and prepare suggestions for the E.C. It is necessary that this group, on the basis of available information and the results of the Budapest Symposium, should prepare a concrete suggestion for the activity of WFSW in regard to cooperation with developing countries for the next meeting of the E.C.

The E.C. should study the possibility of helping the establishment of regional centres for scientific training and research where several developing countries cooperate, to help them in training their scientific cadres.

The EC should study the problems of scientific documentation which becomes a serious problem even in advanced countries.

The E. C. should encourage the regional centres of the WFSW to hold symposia for studying specific scientific problems of the region and play an active role among the countries of the region, to help them in increasing the exchange of scientific personnel and scientific material.

It is recommended that the E.C. sends a delegation of the WFSW to Latin America to contact local scientific organisation and to make an endeavour to establish a regional centre of the WFSW in Latin America.

Through the regional centres, the WFSW can help to establish contact between scientists working in the same field inside and outside the region.

The WFSW should use its influence to encourage international cooperation including cooperation with appropriate agencies for research, training, exchange of scientific personnel and dissemination of scientific information.

The WFSW should approach the Governments concerned and stress to them the great importance and the benefit of their countries from contacts between their local scientists and those in other countries through publications and the attending of different scientific meetings. The Assembly demands equal rights for all scientists from all countries to travel freely for scientific purpose.

The Assembly resolves in particular that the EC and the affiliated organisations should exert their influence to put an end to the discriminating and humiliating processes to which scientists whose passports are not recognised by several countries, have been subjected. (For the delegation of the German Democratic Republic).

The EC should instruct the Editorial Board of SCIENTIFIC WORLD to devote maximum and planned attention to obtaining and processing materials concerning the economy, culture and science of developing countries, the experience of different countries with the cooperation with developing countries and to the struggle of these countries against neo-colonialist and other imperialist and hostile tendencies to achieve a genuine freedom. Particularly it is necessary to ensure a lasting contact with correspondents in these countries. It is recommended to take the necessary measures for ensuring this task within the scope of the activities of the Editorial Board.

Popularisation of scientific knowledge should form an integral part of the development of science and technology. In this connection it is recommended to exchange lectures, programmes and films etc. on international scale; study the techniques of popularisation and organise international meetings on the popularisation of science.

Reports from Branches of ASWI

Karaikudi Branch

The new Executive Committee took charge in May. Since then, a number of meetings of the Executive and the General Body have been held in connection with important work relating to the improvements in general both relating to problems of scientific workers inside and outside the Institute. A number of resolutions were passed at these meetings. These resolutions were amply discussed and those relating to centre were sent to the General Secretary (Organisation) at the Centre for necessary action. Some of these resolutions related to the enhancement of the amount of Junior and Senior Research Fellowships, grant of subsidies for the purchase of science books and journals for each scientific worker by the Council, fixation of salaries, counting of previous service rendered by the scientific workers in other research organisations both government and semi-government, revision of LTC rules and waiting list of selection committees. We are glad to know that the increase in amount of the Senior and Junior Research fellowships have since been considered by the CSIR. Individual cases were also discussed. Some of the resolutions pertaining to providing of some auxiliaries such as aprons, gas masks, goggles etc., were also considered and the authorities of the Institute have been requested to provide them whenever required by the scientific worker. This has since been approved by the Director. Attempts have also been made by the ASWI to request the Director to extend present canteen facilities beyond office hours so that scientific workers working after office hours may make use of the facility. This has also been done. The resolution regarding the authorisation of countersignature by other members of the scientific staff has also been approved to a large extent by the Director and now some members in a section can countersign indents even in the presence of the Head of the section. A three day discussion was held on a very interesting topic namely 'Reasons why young and younger scientific workers are unable to work beyond office hours even when facilities are existing for work'. Several difficulties were pointed out and discussed at length. The Director promised to look into all matters with a sympathetic view.

A number of topics covering almost all branches of electrochemistry were suggested to the various scientific workers for giving lectures on behalf of ASWI. Attempts are made to arrange such lectures whenever possible.

Scientific workers have been requested to approach individually any renowned personality in the field of science and allied subjects for giving general lecutres on their topics. The Director has very kindly agreed to help the ASWI, as far as possible in regard to the stay and other facilities for such a person. Two lectures were held, one by the Director on the Impression of his visit to West Germany and the other was by Dr. H. S. Jaggi on 'Missiles'.

Out of a total strength of about two hundred scientific workers in the Institute, one hundred and thirty are members of ASWI. We hope others will also join us at an early date.

Roorkee Branch

Apart from the normal activities of this Branch this year, the Branch started publishing a Wall News Paper (Monthly), entitled 'ROCKET' prepared and caligraphed by the members of A.S.W.I. This brings out scientific and general information of interest to the Scientists.

This year, the Branch arranged a 'Children's Day' on the occasion of the birth day of the late Pt. Jawaharlal Nehru. About 150 children took part in the various competitions, like Paintings, Science Quiz, Memory Test, Arithmetic Race etc. The prizes were awarded to the winners.

CSIR Branch

With the increase of membership to 110 (subscription paid) the branch now consists of three separate units :

(a) The Publications Directorate Unit

(b) The Insdoc Unit, and

(c) The Central Office Unit

The following have been the activities of the Branch :

Lectures and Discussions : Papers on the undermentioned topics were read and were followed by lively discussions :

(*a*) The Usefulness and Nuisance value of the Rules of Botanical Nomenclature;

(*b*) Modern Concept of Photo-synthesis;

(*c*) The History of Earth;

(*d*) The Breakthrough.

The last mentioned talk was delivered by the famous writer Dr. Mulk Raj Anand. About 200 people availed themselves of the opportunity to hear Dr. Anand.

A special meeting was held to consider a proposal to change the name of Vijnan Karmee, the official organ of the ASWI. The meeting resolved that the name Vijnan Karmee be retained.

The branch is arranging a session of the scientific advisers from the embassies of U.K., U.S.A. and U.S.S.R. for a panel discussion on various scientific topics.

Membership Drive : Various scientific organizations in Delhi, including the University of Delhi, were approached with a view to enlisting members. Surprisingly, there were a good number of scientists who were not aware of the existence of ASWI. In order to acquaint the scientists with the aims and objects of the ASWI and to provide them with application forms, a small pamphlet has been designed. Copies of this pamphlet will be distributed to various branches for the purposes of membership drive.

It is a pleasure to announce that the discrimination between the technical scientists and the information scientists, working in various units of the CSIR has been completely abolished.

Jammu Branch

Elections were held during the 1st week of March, 1965 and the following were elected office bearers :

Dr. B. J. Ray Ghatak	(President)
Dr. K. S. M. Sastry	(Secretary)
Shri M. M. Gandotra	(Jt. Secretary)
Miss Illa C. Vora	(Treasurer)
Dr. C. K. Atal	(Member)
Miss R. K. Jamwal	,,
Shri S. K. Chaturvedi	,,
Shri J. L. Suri	,,
Shri Ajit Singh	,,
Shri H. R. Khajuria	,,

Executive Council of the Branch met for more than 8-10 times to discuss and decide some of the important matters connected with the welfare of the members.

Executive Council also took part in nominating committees for auditing the accounts of the Association upto 1965 and also agreed to have a Finance Committee consisting of three persons to look into the budget arrangements for the current year. An Information and Literary Committee was also formed to carry out and to help the Secretary in social and literary activities of the Association.

Two special committees appointed by the Association looked into the grievances of the some of the members and the grievances were removed by taking up the matter with the concerned authorities.

Executive Council of the Branch accepted the resignation of Miss Ila C. Vora and nominated the new Treasurer.

Several talks were also arranged by the Association. These included a talk by Mr. C. P. Vora, the Everest Hero, about his experiences on the Himalayas. The Branch also took active part in celebrating the birthdays of our National Leaders, Mahatma Gandhi and Jawaharlal Nehru. The Branch collected Rs. 585/- towards Nehru Memorial Fund and remitted the amount to the Secretary, Nehru Memorial Fund, Teen Murti Marg, New Delhi.

During the Pakistani aggression, all the members of the association stood like a solid rock unitedly to face the hostility and tried to solve the difficulties arising from time to time. The Branch took active part in enforcing civil defence measures and collected 24.5 litres of blood to save the lives of our wounded Jawans. Members of the Branch also took active part in First-aid programme and gave necessary help, wherever needed, by Civil Defence authorities.

The Branch contributed Rs. 101.00 towards the Prime Minister's National Defence Fund and helped in collecting food and clothing etc. for supplying to the displaced personnel. The members of Jammu Branch are proud enough to say that they gave their full support and help to the Government to face the situation courageously and they are well prepared for any eventualities arising in future emergencies. Their humble services to the cause of science and to the development of the nation can always be depended upon.

Mysore Branch

Membership : The membership of the Branch remained stationary at about 160. About 25 persons discontinued their membership and almost an equal number of new members were enrolled during the year.

Except for two members from the University of Mysore, all the members are from CFTRI. Our efforts to enrol members from the Central Sericultural Research Institute and the Defence Food Research Laboratory, both situated at Mysore, did not yield result owing to the Association not being a recognised one.

The executive committee for the year elected in January '65, consisted of a President, two Vice-Presidents, an Honorary Secretary, a Joint Secretary, a Treasurer and 13 members.

Rafi Ahmed Kidwai Prize for Horticulture awarded by I.C.A.R. in 1963.

A sub-committee of the Branch prepared a study report on the subject matter of the award. The report was placed before the general body of the Branch. The executive committee deliberated over what further action should be taken over this matter. The concensus was that the action should be taken after due consultation with the Central Executive.

Employment pattern in CFTRI

Another sub-committee of the Branch prepared a report on the Employment Pattern in CFTRI. The report completed and analysed data regarding (i) qualification vs. cadre on first appointment, (ii) time taken for getting promotion in different cadres, (iii) qualifications vs. cadre at the time of compilation of the report and (iv) years of service in the cadres at the time of the compilation of the report.

The report was presented before a meeting of the Branch and it generated a healthy debate on the formulation of advertisements, formation of selection committees and the system of interviews. The need was generally felt for evolving a rational, uniform and adequate recruitment and promotion policy based on well defined criteria for assessment of performance and achievement. The need was also felt of taking measures to improve the basic technical qualification of B.Scs. already employed. The Branch is starting a course covering the syllabus of A.I.C. examination for 1966 with help of the staff of CFTRI & Mysore Union.

Dr. Mulk Raj Anand delivered an address on "Art and Science—A single realm" before an audience of the Branch on 23rd June 1960: A report of the address has been published in Vijnan Karmee (Vol. XVII, No. 6).

A socio-economic survey of the Scientific Workers in CFTRI is being conducted under the auspices of the Branch with the help of a sociologist and a statistician. The objective of the survey is to find out whether and to what extent socio-economic conditions aid and abet work efficiency.

Other subjects, which have formed the matter of our discussions and which may enlarge into later studies, are:

(i) A comparison of the methodology of recruitment to scientific service in various countries.

(ii) The cumbersomeness of and discrepancies in the administrative procedures in respect of medical concessions available to our staff.

(iii) Expeditious action needed to materialize the CSIR decision regarding assessment of SSA /STA's and scientists for promotion to higher cadres after five years of service in their cadres.

The Branch took up with the authorities of CFTRI, the feeling of the staff in workshop and allied unit of CFTRI that they were discriminated as they had their working hours different from the rest of the Institute. The authorities have tentatively changed the timings of the Institute to five working days of 8 hours a day, with Saturdays & Sundays as closed days.

U. P., P.W.D. Research Institute Scientific Workers' Association

The Association of Scientific Workers of P.W.D. Research Institute, Lucknow has 27 members. The membership is 100%.

This year a meeting was held on 24-7-65 in which outgoing Secretary Dr. T. N. Chojer read his report and new executive committee was elected.

The next meeting was held on 7-9-65 to condemn Pak aggression. 11 members out of 27 offered to donate their blood for the jawans and all had contributed their one day salary for defence fund in September 1965. A resolution was passed condemning the attack and whole hearted support was pledged to the Government.

The following were elected the office bearers for this year.

President	:	Dr. Manohar Lal
Vice-President	:	Dr. T. N. Chojer
Honorary Secretary	:	Sri Yad Hasan
Asstt. Secretary	:	Sri S. C. Misra
Treasurer	:	Sri B. N. Vaish

Members of Executive

1. Sri J. P. Bhatnagar
2. Sri R. N. Nagar
3. Sri R. S. Dixit
4. Sri B. B. Lal
5. Sri S. S. Ahmad

Auditors

1. Sri Zair Hussain
2. Sri C. M. Nagar

In U.P., P.W.D. Research Institute, the Engineers and Scientists, although working side by side,do not enjoy same status and privileges, which is not very healthy & conducive for work and unless they are treated *at par*, no proper atmosphere for research can be created. The general concept of treating equally the Scientists & Technologists (Engineers and Overseers) should be applicable to U.P., P.W.D. Research Institute scientific workers as well. They should be given similar emoluments, special allowances for Post-graduate degrees and diplomas and chances of promotion within the department and also equal opportunities be afforded for seeking outside employment atleast once a year, as in C.S.I.R. Labs.

The U.P., P.W.D. Research Institute Scientific Workers' Association has been focussing the attention of U. P. Govt. since 1959, on all above burning problems but although the Association is recognised by Govt. vide their letter No. SN/Kha (Vibhag) G.O. No. 4090-EBR/XXIII-PWB-42EBR/56 dated 28-1-59 to Chief Engineer, P.W.D., this recognised Association has not been favoured with a single reply to their various resolutions in these 7 years nor a deputation has been granted by the authorities (Ministry/C.E.) to give them a patient hearing and understand their problems.

The resolution regarding forwarding of applications was adopted in last meeting and it has to be considered again particularly in the above context that:

(i) The nature of duties/responsibilities of Technologists (Engineers and Overseers), Scientists (J.A.C. & Asstt. Chemists) working in this institute are exactly similar.

(ii) The engineers are granted better pay scales and facilities of higher start and special pays for Post Graduate Diplomas etc. and can rise to C.E./S.E.'s level within the department. They are allowed to seek employment outside the department or granted deputations for foreign service and also they are generally transferred after 3 years as the posting is done from cadre personnel where as the scienstists are devoid of all the facilities narrated above and are also put under restricted category and thus debarred from seeking employment in other state/central research oraganisations at Lucknow.

(iii) In the expansion of P.W.D. Research Institute, mostly engineering posts like overseers, A.E.'s, Executive Engineers/Superintending Engineers are created for the work which can be better looked after by Junior Asstt. Chemists/Asstt. Research Officers/Research Officers who have more research experience due to their constant association with the institute.

(iv) In view of policy at (iii) above, L.A.'s are not promoted as Junior Asstt. Chemists and Junior Asstt. Chemists to Research Officers and Asstt. Research Officers to Research Officers and the promotion chances of all scientists working in the institute are completely blocked both in bettering their career and status within or outside the department.

THE FOLLOWING RESOLUTION WAS ADOPTED

Resolved that for putting their best in the cause of research, Engineers, Technologists and Scientists working in P.W.D. Research Institute should, like other engineering institutes of Government of India, C.S.I.R. Labs. etc., be treated *at par* in the matter of their pay scales, initial starts, grant of special pays and allowances for Post Graduate degrees, diplomas or arduous duties and their applications be also forwarded once or twice a year, as is the policy in C.S.I.R. (vide letter Nos. 14(11)/CLE—I Dt. 23-11-62), for outside employment.

Further in order to attract best talents & retain mature, experienced, qualified personnel, their service conditions be made a bit more attractive by providing ladder of promotions in deserving cases—L.A.'s to J.A.C.'s, J.A.C.'s to A.R.O's., A.R.O.'s to R.O.'s and R.O. to Director by creating more such posts for engineers and scientists (50:50 basis) in research institute & in newly established Test House at Lucknow. This policy will greatly remove the frustration amongst Scientists of U.P., P.W.D. Research Institute. In order to remove stratifications and hierarchy in C.S.I.R., all distinctions between different cadres of scientists have been removed and the same should be followed in U.P., P.W.D. Research Institute so that Scientists and Engineers may have a feeling of equality so very necessary for healthy growth of ideas through mutual free criticism and discussion.

KHAMARIA BRANCH

SHRI S. J. SHAHANEY

The news of the sudden demise of Shri S.J. SHAHANEY on 26.10.65 came as a great shock to all of us. He was an extremely energetic, capable and experienced man. During tenure as Director General of the Ord. Factories, he kept up the steady flow of armament production in the crucial period of the Sino-Indian War in 1962 and Indo-Pak War this year. We can ill-afford to lose the services of a man of his calibre at this critical juncture. This is national loss. Our heart felt condolence to the bereaved family.

THE FOOD SITUATION IN KHAMARIA

Madhya Pradesh has long been considered a surplus state. Even in the worst days of scarcity, people in this state have never felt the pinch of food deficit. In fact, there has never been any necessity of rationing. But this year mysteriously this picture has changed. Rice and wheat have suddenly become scarce. In Jabalpur-Khamaria where heavy Defence Production is concentrated, a kind of rationing system is in vogue at present which is absolutely inadequate and far from equitable. Only 2 Kgs. of rice and 4 Kgs. of wheat per week per householder (card), irrespective of the number of members are being issued. This has further been reduced to 6 Kgs. of rice and 15 Kgs. of wheat per cardholder per month. To get this, people have to wait in long queues for hours. This is a great hardship, especially for the Ordnance Factory Workers who have to spend the best part of the day working inside the Factory.

While it is true that this year the seasonal conditions have not been too favourable, still it would appear that the present situation is artificial. In the past also there have been failures of the monsoon but conditions never became so misearable as now. It appears both rice and wheat are available in the black market at fancy prices. We do not know whether there has been some bungling somewhere. If the present conditions are allowed to continue or deteriorate it may lead to serious consequences. This will be a great calamity especially in Khamaria, as it would seriously affect Defence Production. Things have to be set right as early as possible.

The present quantum of ration is absolutely meagre. 6Kgs. of a rice and 15 Kgs of wheat per month may be alright for a single individual, but absolutely inadequate for an average family of 4 members, not to speak of bigger families. The scale should be at least 8 oz. per head per day.

We would also suggest that, if possible ration should be made available through ration shops administered under official auspices. Such a system existed in the previous rationing period i.e. about 1942-50, when Factory authorities had some arrangement with the Army Supply Corps. Full months quota used to be issued in the beginning of the month itself. This will be very convenient for the employees, as this will save them the trouble of going to the ration shop week by week and waiting there for hours. Whatever be the system of the rationing, we would submit it for further consideration of the authorities that the morale of the Ordnance Factory Workers has to be taken into account. We request the Minister of Defence and DGOF to do something in the matter urgently.

INSPECTION VERSUS R AND D

There has been influx of personnel in promotion from the R & D establishments to the Inspection. Such transfers have been one sided with the result that junior employees who remained in R & D side after bifurcation, are now returning to Inspection side in higher ranks, superseding the claims of the Inspection Staff, who are much senior. This sort of one-sided influx is unfair and should be stopped. DPC promotions should be departmental only and not interdepartmental. R & D and Inspection have been separated and should remain so.

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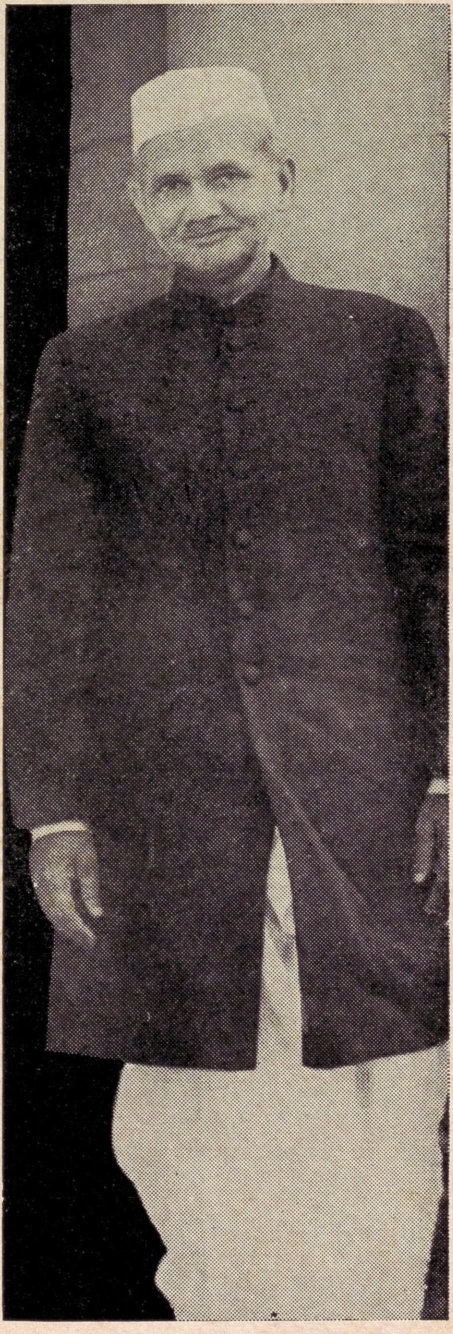
ASWI Mourns the death of Shri Lal Bahadur Shastri



Resolution passed by ASWI at a condolence meeting held in New Delhi, on 15th January, 1966.

This extraordinary meeting of the Association of Scientific Workers of India deeply mourns the sad and untimely demise of our beloved Prime Minister Shri Lal Bahadur Shastri. The eventful 19 months during which Shri Shastri adorned the highest public office of the country, were marked by events that unfolded his personality as a man of great courage, determination and statesmanship. He won glory in mobilising resistance to aggression and then championing the cause of peace in the sub-continent. He introduced a glorious chapter in the history of the country in this short span of time.

His faith in science and sympathy for advancement of science in India and welfare of scientific workers in particular was well known. This meeting prays that his soul may find peace in the eternal abode. This meeting also places on record its heartfelt sympathy for Mrs. Lalita Shastri and other members of the bereaved family and sends its condolences to them.

Resolved further that a copy of this resolution be forwarded to the members of the bereaved family.

Editorial

SCIENCE AND MR. SHASTRI

If Jawaharlal Nehru had a passion for science and was actually conscious of its social aspects, Mr. Shastri had none of it. In his approach to social values, Shastri's personality had shades of Gandhiji. While Jawaharlal Nehru arrived at the correct decisions in matters of science and technology through a process of reasoning, Shastri like Gandhiji came to the same conclusions through the rare gift of right instinct. In all major problems affecting science and technology and their social role, Mr. Shastri struck the right chord and whenever called upon to do so, took the correct decision. In controversial matters, like Gandhiji Mr. Shastri would hold his patience till the dust of conflict and controversy had settled down and the perspectives were clear. He would then with disarming clarity propound the right arguments and give his decision. Most of the scientists are aware of the recent controversy that ranged on the question of financial support for scientific and industrial research. The financial crisis had hit hard every sector of our activity and the government had promulgated a 10% all round economy cut in the budgets of every department including CSIR and Atomic Energy Establishment. Enlightened public opinion in the country was shocked and dismayed. Examples from other countries were cited to expostulate the positive role of science and technology as creator of national wealth and factor in productivity. Scientists argued that a cut in expenditure on science and technology (finances for which were already inadequate) could only retard the wheels of progress. On the other hand, financial authorities were intent upon uniform application of their policy decisions on all departments making no distinction on the basis of the role of scientific research in industrial and economic development. It was left to Mr. Shastri to pronounce judgement and declare in clear and precise terms that scientific research and technology would not be permitted to suffer for lack of funds. It is well known that even after this pronouncement the battle was not won. The finance authorities fought back and insisted upon the cuts on the budgets of the scientific and educational organisations notwithstanding the support of the public, the Planning Commission and other responsible bodies. It goes to the credit of Mr. Shastri that his Cabinet ruled out any cuts and sanctioned adequate funds for science and technology. It is a tribute to his right instinct that Mr. Shastri put his foot down and saved the vital sector of scientific research from damage.

Again, in the matter of utilisation of indigenous know-how and rationalisation of the policies in regard to foreign collaboration, the country found Shastriji pronouncing the correct decisions. After the recent conflict with Pakistan it became clear that the country had depended far too long on foreign aid, that the policies in regard to industrial development had been based on foreign collaborations even where this could be avoided; that these policies had brought in their wake complications in utilisation and development of indigenous know-how. Indiscriminate collaborations and import of foreign know-how stood in the way of a healthy and a natural growth of science and technology in the country. Perhaps, Mr. Shastri was no social analyst who was pronouncing his judgement on the basis of well documented literature or statistical appraisals. Here again with an instinct all so rare, he denounced the overwhelming dependence on foreign collaboration and lent powerful support to the forces struggling for self-respect and self-dependence in the economic and technological field. He correctly identified the food and agriculture front as the Achilles heel in the country's economy and went so far as to suggest that at least for one year the resources and attention of the country should be concentrated to achieve a break-through on the food front. While side-stepping any drastic measures that may disturb the existing land relations or even the distribution pattern, in true Gandhian spirit he advocated self-denial and sacrifice combined with measures to grow more food through use of fertilisers and utilisation of the achievements of agricultural research in the actual field operations.

On the all too crucial question of atom bomb and world peace, he took a clear and categorical stand against the development of atom bomb in this country and threw his weight on the side of peace and against the proliferation of nuclear weapons. Under his instructions our representatives in the international councils advocated the cause of world peace and nuclear disarmament. After the recent aggression, the forces of communalism and reaction siezed the opportunity to press the demand for a change in policy towards development of atom bomb in the country. A significant section amongst the scientists also got derailed in their thinking and started demanding that Atomic Energy Establishment should devote their resources to the development of nuclear weapons. The economic and social consequences of acceptance of such a policy would have been disasterous for the Indian economy. Under powerful pressure from the vocal sections of the public for a time, Mr. Shastri wavered and even declared that India would not prepare a nuclear bomb "for the present" but here again with his natural gift of the 'correct instinct' he came back to the original position that nuclear energy will not be used for destructive purposes and India will not launch in the direction of destructive uses of atomic energy. Perhaps it was a realisation of the fact that the warlike psychology and militaristic tendencies in the country were on the increase, which led Mr. Shastri to make a powerful bid for peace with honour at Tashkent. By reiterating the peaceful policies of this country, Mr. Shastri enriched the tradition of peace built by Gandhiji and Jawaharlal Nehru.

History does not lack in instances where rigid reasoning has led to decisions unreasonable — where scientists have acted in a manner totally unscientific. It is equally rich in instances where men of goodwill and those blessed with humility, gentleness, sincerity and nobility of heart have come to the right decisions and have led their countries on the path of glory, democratic freedom and peace. Mr. Shastri was such a one. The country, the world and those who believe in the role of science for human progress and peace are poorer by his loss.

Frankly Speaking

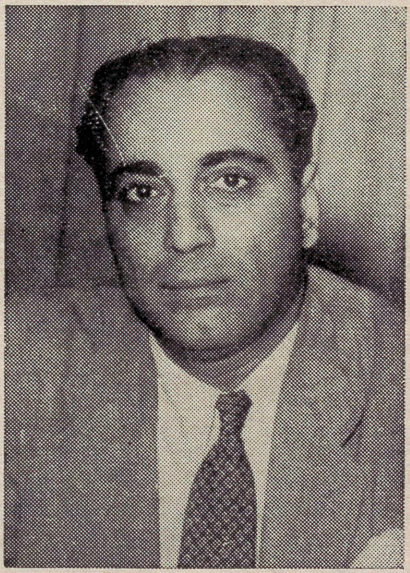
PATENTS & PUBLICATIONS

Even in scientific institutions abroad there are no set rules regarding authorship of research publications or patents. However, the rich traditions of integrity and fairplay in the field of science have prevented any usurpation of the rights of the deserving. Healthy tradition has also stood in the way of persons in authority gaining unfair advantage. Most of the scientific institutions in India have yet to build such traditions. Recently there have been instances of seniors getting their names put in as authors of patents and research papers in a manner that bodes ill for the healthy development of traditions in a scientific research. It is becoming a common practice to accept inclusion of the names of the heads of institutions, professors, directors of laboratories and sometimes even deputy directors and assistant directors who have no relation with active research work on the subject of the paper or the patent. In the present dispensation, so much of the time of professors, heads of the departments, the directors, deputy or assistant directors of laboratories is spent on meetings, shuttling back and forth all over the country for committees and commissions, that leaves them little time for any calm deliberation, thinking or creative contribution to research. Usually, they come in by way of 'supervision'—which consists of periodic chat with the research worker as to how he is progressing and learning back from him as to what he has done, how he has been engaged, what results have been obtained and a general appreciation and blessing to his efforts. The traditions, whereby the professor or the senior scientist by virtue of superior knowledge, were regarded as Guru, who gave inspiration and active help to his disciples, are fast dying out. These are the days of committee men and spokesmen.

These are the people who stay in the limelight. As a result, the association of these prominent names lends respectability to the research papers and patents and facilitates their acceptance and publication by reputed journals. This serves as a temptation to the research workers, who are usually illplaced, to become an accessory to inclusion of names of such scientists. At times invisible pressure is exercised; scientific workers are given to understand that they may be looked upon with disfavour if such names are not included. The research papers/patents could be delayed or kept pending for scrutiny. Things are speeded if certain names do occur. Some institutes have a system whereby no paper can go out unless it has been scrutinised by the Head of the institution or the professor. Even where the real author, the actual research worker, may bear the personal responsibility, communication of results may be withheld or delayed, seemingly to safeguard the good name of the institution. In fact the author may even be prevented from sending the paper by the exercise of superior authority. In research and invention, claim to priority is an important factor and the research workers may be tempted to take the line of least resistance. It was to some such instances that Shri Raghu Ramiah, Minister for Supply & Technical Development, made a reference in his speech in the recent 'Get-Together of Research & Industry'. A few years ago, the Ministry of Education had issued a circular that any scientist can publish a paper containing data on his own research without reference to superior authority. Most of the institutions did not enforce this. Similar instructions have also existed for patents. Traditions cannot be built on the basis of governmental circulars—they are built by democratisation and purification of the social and academic life within the scientific institutions and by the assertion of their rights by the scientific workers through their accredited organisations as the ASWI. It will be a sad day for Indian science if the younger scientific workers let sycophancy have the better of the true scientific spirit.

Dr. Homi J. Bhabha, F. R. S.

S. Z. Ali



The passing away of Dr. H.J. Bhabha at the age of 56, in the tragic air crash on Mt. Blanc, is a stunning shock to World Science in general and to Indian Science in particular. His role in the co-operative efforts of the peaceful uses of nuclear energy on the international scale is outstanding. But it was his brilliant conception of the Indian Atomic Energy programme, both in depth and in scale, and its execution in time, that placed India among the advanced countries in this respect. His leadership is hard to replace and the Association of Scientific Workers of India mourns his loss at this crucial moment.

The scientific achievements of Dr. Bhabha, his interest in painting, music and art in general, single him out as a complete man. Born in 1909, literally with a silver spoon in his mouth, Dr. Bhabha received his early education in Bombay upto the age of 17. He then joined Gonville and Caius College, Cambridge for a Tripos in Mechanical Sciences, obtaining the B.A. degree in 1930. For the next four or five years, his interests were in Mathematics and Theoretical Physics, at Cambridge and at other European centres of learning. He worked with W. Pauli in Zurich, with Enrico Fermi in Rome and with H.A. Kramers in Utrecht. Dr. Bhabha's original contributions to physics are in the field of cosmic radiation, the theory of elementary particles and quantum theory. His Cascade Theory of Electron Showers developed with W. Heitler in 1937, is basic for an understanding of the soft component of cosmic radiation and gamma rays. He did some of the earliest work establishing the existence of a new elementary particle, the meson, which owes its name to his suggestion. His prediction of the slowing down of the rate of decay of the mu-mesons with increasing velocity in accordance with relativity and its subsequent observational confirmation, remains one of the best proofs of the correctness of Einstein's Theory of Special Relativity at extremely high velocities. The importance of his work won wide recognition and he was elected a Fellow of the Royal Society in 1941, at the early age of 31.

On returning to India, he became Reader in Theoretical Physics at the Indian Institute of Science, Bangalore, in 1940, and was Professor there from 1942 to 1945.

He had become aware of the immense potential of atomic energy for peaceful uses, even a year earlier than bomb explosion at Hiroshima. This is evident from a letter he wrote to the house of Tatas (referred to by Shri Jagjit Singh in a radio talk recently). In this letter he had the foresight to predict the use of atomic energy for power generation after a few decades and he made a strong case that unless there was a school of atomic physics in India, the use of atomic energy for power generation and other peaceful uses would not be possible, when the time came for such a utilization. He therefore wanted the establishment of an institute of fundamental physics for the basic training and research required for such a undertaking. The Tata Institute of Fundamental Research was established in 1945 and Dr. Bhabha became the first Director and Professor of Theoretical Physics.

The dawn of independence in 1947 and Pandit Nehru's concern and love for science and his persistent attempts for its utilization in national reconstruction, led to the passing of the Atomic Energy Act in 1948. This Act commits the Government of India to the peaceful utilization of atomic energy, and Dr. Bhabha thus was the natural choice for the chairmanship of the Atomic Energy Commission since its inception. Dr. S.S. Bhatnagar and Dr. K.S. Krishnan were the other scientist members. Later, Dr. Bhabha became the Secretary to the Department of Atomic Energy in 1954 and the Director of the Atomic Energy Establishment at Trombay.

Over the years, the Establishment at Trombay has diversified, expanded and consolidated the research and technology required for peaceful uses of atomic energy. Dr. Bhabha's aim in heading the Tata Institute and the Establishment at Trombay appears to have been manifold. The acquiring of basic and fundamental knowledge in nuclear processes by Indian scientists both at home and abroad, the training of successive batches of young scientists, engineers and technologists while the work at the Establishment developed, and the first hand experience of reactor technology, search for the strategic ores—all this had to be carried out with the minimum loss of talent and time. Dr. Bhabha succeeded in this great task.

As knowledge and experience grew, new confidence was acquired which led to the acceptance of new responsibilities in the field of atomic energy. The Atomic Energy Department with its manifold activities and the Establishment at Trombay, have grown into one of the three major scientific organisations in the country, with a total of about 6,000 scientists, engineers and technologists. Divisions dealing with broad fields such as Physics, Chemistry and Chemical Engineering, Electronics, Reactor Technology, Radio-, isotopes, Health Physics, Atomic Minerals have been established. Very valuable experience was acquired by the Indian scientists in reactor science during the designing, fabrication and installation of the reactors Apsara and later the CIR with Canadian consultancy. The teething troubles with CIR were overcome without Canadian help during 1963, an outstanding example of self reliance when this slogan was not even thought of. The third reactor, Zerlina has been designed and set up as an experimental reactor in which the parameters can be changed. This was erected to allow Indian scientists and engineers to acquire the know-how about the designing and running of atomic energy power plants. Bhabha's policy on foreign collaboration was clear. He stated it barely a fortnight before his death, on 7th January, 1966 while speaking on "Science and the Problems of Development" (published in this issue, pp. 10-22) under the auspices of the International Council of Scientific Unions. According to him, a self-generating industry was possible only if a powerful scientific base was created, and unless powerful scientific and engineering groups were established during the construction and operation of existing plants, as a matter of deliberate policy, the dependence on foreign technical assistance would continue. On the other hand, where a strong scientific and technological base had already been laid, foreign collaboration could certainly lead to a quicker take-off.

While the three reactors were designed and built by our own scientists, it was decided to invite world tenders for the supply and erection of the first nuclear power station at Tarapore. This station will produce about 380 mega watts of electricity and is scheduled to go into operation during 1967-68. The second atomic power station at Rana Partap Sagar in Rajasthan with two reactors, each producing 200 mega watts of electricity, has been based on a Canadian design. The prime responsibility for constructing this station with the assistance of a Canadian firm of consultants, is that of Atomic Energy Department.

The third station at Kalpakkam near Madras was envisaged by Dr. Bhabha to be entirely built by Indian scientists, without any foreign consultancy. The rapid industrialisation of these zones, far from the coal or hydro-power regions, is thus ensured by the atomic power stations.

The erection of a heavy water plant at Nangal and of a large plutonium recovery pilot plant at Trombay, has ensured the supply of heavy water and of plutonium from the used fuel elements. Both these plants have been in operation and at the formal inauguration of this plutonium recovery plant last year, Dr. Bhabha emphasized the need for erecting a full scale industrial plant during the Fourth Five Year Plan, based on the present design and experience. The importance of the recovery of plutonium lies in its strategic use. Though this can be used in the production of atom bombs, its use is imperative in reactors using thorium in the fuel elements. The use of thorium can thus lead to the breeder reactors which produce atomic fuel even as they consume it to sustain the atomic chain of reaction. Dr. Bhabha emphasized the urgent need for research and development on thorium utilization, since this was a specific Indian problem, not yet taken up by the West. With our immense reserves of thorium, we can thus become self-sufficient in electrical energy, even to a level of the U.S. standards.

The great diversification and intense work of the Indian Atomic Energy Department is a tribute to Dr. Bhabha's foresight and ability in the choice of scientists to undertake this activity. The exploration for and the exploitation of the uranium ores at Jaduguda, the establishment of the base for the electronics industry thereby ratrieving the hopeless situation of dependence on foreign imports in this strategic field, the production of radio-isotopes for medical and agricultural research, not only for Indian needs but for the South East Asian region —these and other activities are again a tribute to Dr. Bhabha's broad vision.

Dr. Bhabha had become a member of the Association of Scientific Workers of India almost since its inception. On many occasions we derived great support from him. Only recently, he was good enough to preside over the session on "International Collaboration" during the Symposium "Science and the Nation" organised by the A.S.W.I. We mourn the loss of Dr. Bhabha from our midst, the loss of a great scientist, administrator and the architect of the Indian Atomic Energy Programme.

Science and the Problems of Development*

Dr. H. J. Bhabha

This talk on Science and the Problems of Development will be based mainly on our experience in India during the last twenty years, but much of what we have to face here may be common to many underdeveloped countries, and some of them, I hope, will be able to profit from our experiences, both successful and unsuccessful. It is interesting to note that practically all the ancient civilisations of the world—Persia, Egypt, India and China—were in countries which are today underdeveloped. This is not surprising, since most of the countries of the world are still in this category. Western Europe is in fact a small area of the globe which outstripped the rest, essentially from the time of the Industrial Revolution, because of its development of modern science and the enhanced ability this gave it to utilise the forces of nature and to thus achieve a much higher material standard of life for its people. She was followed, and indeed to some extent overtaken, in industrial development by the United States, and more recently the category of the industrially developed countries has been joined by the Soviet Union, Japan and a few others. A major part of the world, however, still remains underdeveloped by these standards. What the developed countries have and the underdeveloped lack is modern science and an economy based on modern technology. The problem of developing the underdeveloped countries is therefore the problem of establishing modern science in them and transforming their economy to one based on modern science and technology. An important question which we must consider, is whether it is possible to transform the economy of a country to one based on modern technology developed elsewhere without at the same time establishing modern science in the country as a live and vital force. If the answer to this important question is in the negative, and I believe our experience will show that it is so, then the problem of establishing science as a live and vital force in soceity is an inseparable part of the problem of transforming an industrially underdeveloped to a developed country.

Science has formed part of the activity of Indian universities for many decades and Government itself has had some scientific departments, like the Geological Survey of India and the India Meteorological Department, for quite some time. Indian scientists such as Raman, S. N. Bose, Saha and several others have made important contributions to the progress of science, which are now part of the fabric of modern science. But science as an organised national activity has been given an important place in the national life only since Independence, thanks primarily to the vision and powerful support of our late Prime Minister, Jawaharlal Nehru, though some steps in this direction had already begun to be taken a little earlier, as for example by the establishment of the

*Speech delivered by late Dr. H. J. Bhabha, Chairman, Atomic Energy Commission at the time of general meetings of International Council of Scientific Unions, held at Bombay during January 6—10, 1966.

Council of Scientific and Industrial Research and the Tata Institute of Fundamental Research.

I think it only appropriate that I should recall at this stage the immense debt that Indian science and scientists owe to Jawaharlal Nehru. Science was an essential, indeed basic, component of the India which he sought and worked so hard to build. "It is now patent", he said, "that without science and technology we cannot progress". So great was his zeal for science and for the scientific approach to life that he missed no opportunity of imparting his views to others. To quote: "You know that whenever the chance offers itself I say something about the importance of science and its off-shoot, technology. I think we should realize how modern life is an offspring of science and technology". And he fully realised that modern science and technology were as necessary for a highly developed agriculture as for industry. "After all", he said, "how has agriculture grown in many other countries greatly? It is because of the application of science and technology. If modern life depends so much on science and technology, then we must seize hold of them, understand them and apply them." He saw the essential role of science in its historical perspective, not only in transforming the material environment, but in transforming man. To give only one more quotation. "Science has developed at an ever-increasing pace since the beginning of the century, so that the gap between the advanced and backward countries has widened more and more. It is only by adopting the most vigorous measures and by putting forward our utmost effort into the development of science that we can bridge the gap. It is an inherent obligation of a great country like India, with its traditions of scholarships and original thinking and its great cultural heritage, to participate fully in the march of science, which is probably mankind's greatest enterprise today."

If a scientific outlook is to be made a part of the mental make-up of every individual, then clearly his education has to be moulded accordingly. Not only must science be taught at the secondary school stage, but his scientific education must commence much earlier with the help of scientific models and toys. But to be able to do this implies that scientific activity should already have been well developed in the country. Above all, scientific teaching and research at the universities must be strengthened and expanded. The Universities are, however, autonomous organisations, jealous of outside interference, and the process must necessarily be slow and time consuming. It is probably for this reason that it has been considered expedient in many countries to set up national research laboratories and other scientific organisations for specific subjects.

The aim of establishing science as an important national activity has been attempted to be achieved in India through a number of governmental and quasi-governmental organisations working more or less independently, the most important among these being Atomic Energy, the Council of Scientific and Industrial Research, and Defence Science. The methods followed in all these have been different and it is therefore instructive to take up the two largest of them, namely, Atomic Energy and the Council of Scientific and Industrial Research, as case studies to see the advantages and dis-advantages of the methods they have pursued. Both these organisations are approximately of the same size, Atomic Energy being some what larger in the total number of scientific and technical staff employed and in the total investment.

The Council of Scientific and Industrial Research may be taken as the first planned attempt on the part of Government to establish a broad base of scientific and technical research in the country, particularly with a view to help industry and industrial development. I would like at this point to pay a tribute to the memory of my friend and colleague, the late Dr. S. S. Bhatnagar, thanks to whose enthusiasm, energy and dynamic personality a large number of national laboratories were established within a period of some seven years. His successors, Professor Thacker and Dr. Husain Zaheer, have carried forward his work with energy and the Council of Scientific & Industrial Research now has some twentyfive laboratories under it distributed throughout the country. In order to free it from the automatic application of all the Government Rules and Regulations, the Council of Scientific & Industrial Research was established from the beginning in the form of a Society with a Governing Body nominated by the Government, which included important ministers and officials, several of the leading Indian industrialists and noted scientists. One of the main advantages of this set up has been that the Council of Scientific & Industrial Research has been freed from recruiting its staff through the Union Public Service Commission, whose methods are both time-consuming and inappropriate for the selection of scientific and technical staff. The opportunity of framing an administrative structure and rules and procedures appropriate for a scientific organisation, which this set up was intended to confer on the Council of Scientific and Industrial Research has, however, been lost to a large extent by the omnibus adoption of Government rules and regulations.

After Independence, the Prime Minister himself became the President of the Council of Scientific and Industrial Research and the Minister of the Ministry to which the Council was attached, became its Vice-President. Besides the Governing Body of the Council which consisted initially of 15 members and today has 34, there was established a Board of Scientific and Industrial Research to advise the Governing Body on scientific matters, and in particular on the allocation of grants to various scientists in the universities and elsewhere for specific research schemes. As I have said, the Governing Body took early steps; to establish a number of national laboratories and central research institutes. The first among them was the National Physical Laboratory, whose construction in New Delhi was started in 1947 and which was inaugurated in 1950, the National Chemical Laboratory likewise inaugurated at Poona in 1950, the National Metallurgical Laboratory in the steel city of Jamshedpur in 1950, and so on all these laboratories were brought into existence in the same way. A Planning Officer was appointed for planning the work and building of each laboratory. The plan was usually drawn up on the basis of the work of similar laboratories abroad, divided into divisions and sections, and an estimate of the staff required made on this basis. An attempt to fill the posts was then made on the basis of advertisement, and invitation also in the case of the seniormost appointments. While this method of setting up a laboratory might give reasonably satisfactory results in a developed country in which science is already an important activity and a large number of scientists already exist in the universities and in other public and private laboratories and research institutes, it has serious disadvantages in a country in which organised science is still in its infancy and the number of available outstanding scientists limited. It either results in an outstanding scientist being taken away from a university or another research institute, or it results in a mediocre one, satisfying the so-called minimum qualifications, being appointed to posts requiring originality, initiative and leadership. As we all know, the so-called minimum qualifications laid down for a post have little meaning in a research institute, and usually result in the floor becoming the ceiling. A result of following this method has been that a number of good scientists have been drawn away from the universities into the national laboratories, leaving the universities weaker thereby. Thus for example the late Dr. K. S. Krishnan, who was then Professor of Physics at the Allahabad University, was taken as the first Director of the National Physical Laboratory, and more recently, his successor has been obtained by taking a Professor from the Banaras University. Similarly, the first two Directors of the National Chemical Laboratory, were eminent scientists who were brought to India from abroad, while for the third the Head of the Department of Chemical Technology of Bombay University was taken, and the appointment of his successor will deprive the same University department of yet another senior worker. These are not isolated instances, since the attempt to fill senior posts by mature scientists from outside must inevitably lead to their being taken away from the only institutions which have scientists in some measure, however inadequate, in an underdeveloped country, namely, the universities. It cannot be disputed that the cost of building the national laboratories on the lines followed by the Council of Scientific and Industrial Research has been a weakening of the universities by the drawing away of some of their good people, which is their most valuable asset.

I must emphasise that these critical remarks are in no way aimed at individuals but at the system. The standard method of planning laboratories and filling posts is often forced on many by the administrative and financial requirements of Government. As Professor Blackett has said : "We must endow ability whenever it is found, and we must guard against subsidising mediocrity". The standard method is certainly not conducive to achieving this aim. Government is spending large sums now on supportting scientific research and technical development and it is in Government's interest to study and devise *de novo* the best administrative and financial procedures for scientific institutions and for getting the maximum return on the money spent. To apply existing administrative and financial procedures, devised for an entirely different purpose, to scientific institutions is largely to defeat the purpose which the Government has in view and to let the tail wag the dog.

I turn now to Atomic Energy for a case study of a scientific organisation which has been built up by an entirely different method, a method which might be described as "Growing Science". An Atomic Energy Commission was established in 1948 in the Ministry of Natural Resources and Scientific Research to survey the territories of the Indian Dominion for the location of useful minerals in connection with atomic energy, to promote research in their own laboratories and to subsidise such research in existing institutions and universities, and to take such steps as may be necessary from time to time to protect the interests of the country in connection with atomic energy. Its decisions were implemented through the Ministry of Natural Resources and Scientific Research. Instead of planning a number of new laboratories, the Commission decided to use the existing institutions to do the preliminary scientific work and to develop the scientific personnel that would be needed. Foremost among the institution which was so used, was the Tata Institute of Fundamental Research, and the history of atomic energy in India during its initial stages is so bound up with this institute that it merits special consideration.

The Tata Institute of Fundamental Research was founded in 1945 as a joint endeavour on the part of the Sir Dorabji

Tata Trust and the then Government of Bombay, on the initiative which I took in 1943, when I was a Professor at the Indian Institute of Science at Bangalore. At that time there was no scientific institution in the country which had facilities for original work in subjects at the frontiers of knowledge in physics, in particular, nuclear physics, cosmic rays and high energy physics. I accordingly pointed out to Mr. J.R.D. Tata that "the lack of proper conditions and intelligent financial support hampers the development of science in India at the pace which the talent in the country would warrant," and suggested that the Tata Trust might take the initiative in setting up an institute for fundamental research. I also pointed out in a letter dated March 12, 1944, that "when nuclear energy has been successfully applied for power production in say a couple of decades from now, India will not have to look abroad for its experts but will find them ready at hand." The Trustees of the Sir Dorabji Tata Trust decided to accept the proposal and financial responsibility for starting the institute in April 1944, more than a year before the explosion of the first atomic bomb on Hiroshima and before nuclear physics had become what might be called the 'bandwagon' of science. This was also before it had been made public that atomic piles had been successfully operated and long before there was any talk of atomic power stations.

Bombay was chosen as the location for the Institute, as the then Government of Bombay was interested in expanding and improving the level of research work in physics, so that it became a joint founder of the Institute. This is perhaps the appropriate place to mention an important difference between the Tata Institute of Fundamental Research and all except a couple of the national laboratories of the Council of Scientific and Industrial Research, namely that this Institute has been a constituent recognised institution of the Bombay University from the very beginning and has had close relations with many other universities in India, so that students of many of them have done work for the Ph.Ds. of their universities in the Institute.

No organisational chart of the future development of the Institute was submitted either when it was founded or later, and the philosophy has always been to support ability whenever it is found in the fields of work covered by the Institute. Indeed the philosophy underlying the founding of the Institute was the same as that underlying the Max Planck Institutes in Germany, namely "The Kaiser Wilhelm Society shall not first build an Instiutute for research and then seek out the suitable man but shall first pick up an outstanding man, and then build an institute for him." The Institute received financial support from the Government of India from its second year through the Council of Scientific & Industrial Research and the Ministry of Natural Resources and Scientific Research. While the recurring grants from the Tata Trust and the Government of Maharashtra continue, and indeed have been increased, the main financial support for the Institute comes today from the Government of India through the Department of Atomic Energy, the Government of India having undertaken the permanent responsibility of supporting the Institute in 1955. The recurring budget of the Institute during the first year was only Rs. 80,000 which increased steadily at about 30% per annum during the first ten years, and since then has increased at about 15% per annum, the current year's budget is Rs. 150 lakhs, making this the largest national laboratory in the country with the sole exception of Atomic Energy Establishment at Trombay. Since not a single senior post has been filled by obtaining a professor or senior scientist from a university or other research institutes in India, the growth of the Institute gives an indication of the rate at which it is possible to develop scientific research in the country based upon growing its own people, together with the absorption of those returning from studies in universities abroad. The Institute has made it a special point of growing scientists and has now reached the stage when it is able to feed good scientists into the universities, an aim which will be followed to an increasing extent in the coming years.

Apart from supplying people at professorial level, the experiment is being tried of sending small and integrated groups of 2 to 4 research workers into the universities together with the equipment necessary for their work. The university has to undertake to provide them space and treat them as members of their own staff, and it may require each one of them to give not more than two courses of lectures per year. The group is of course selected by mutual agreement to be in a line of work which the university wishes to develop. At the end of the two-year period, the university would be free to absorb the group permanently, and reciprocally the members of the group will have the option to be so absorbed or to return to the Institute. It is expected that these groups will form the nuclei for building up larger schools of research in the universities.

The Institute started work in 1945 in 6,000 sq. ft. of hired space in an existing building. By 1948 its work had grown to such an extent that it was moved to 35,000sq. ft. of hired space in the building of the Old Bombay Yacht Club and it was only in January 1962 that the new buildings of the Institute were inaugurated by the late Prime Minister, Shri Jawaharlal Nehru, some 16½ years after the Institute was founded. This is another noteworthy point in which the growth of the Institute differs from the growth of the Council of Scientific and Industrial Research laboratories. Work has inevitably been built up first and the permanent buildings have come afterwards, and this pattern has been followed also in the development of the whole atomic energy programme. Large and excellent as some of the buildings at Trombay are, some of them are just being completed while the scientific staff who will occupy it have already been built up and the work is in full swing in hired space, much of which is extremely inadequate.

Before I left the institute it may be of interest to give two more examples of building projects and development around people. As early as June 1944, Sir A.V. Hill had written to me suggesting that biophysics was a neglected subject in India and that it should be taken under the wing of the Institute. While I agreed with his suggestion, I did not think that it would be wise to embark on this line till someone was found mature enough to be able to work on his own and build up a group. When however in 1962 my attention was drawn by the late Dr. Leo Szilard to a very promising Indian molecular biologist, it was decided to start work in microbiology, which has since then been growing very satisfactorily.

Another example is provided by the Radioastronomy Group. Four Indian radioastronomers had jointly written identical letters to the Chairman of the University Grants Commission, the Director General of the Council of Scientific and Industrial Research, and to me as the Chairman of the Atomic Energy Commission offering to return to India as a group and establish radioastronomy here, if facilities and support could be given to them. Having ascertained that the members of the group had considerable original work to their credit and were of sufficient maturity to be able to work on their own in India, it was decided to take up radioastronomy at the Institute. Thirtytwo parabolic dishes presented by CSIRO of

Australia, which had been lying unpacked for several years at the National Physical Laboratory, were handed over to the Institute through the willing cooperation of Dr. Husain Zaheer and have been installed not far from Bombay for solar radio-astronomical work. In the meantime a project has been developed for a large cylindrical radiotelescope for studying quasars and other radio sources and locating them accurately by lunar occultation. The telescope, which will have four to five times the collecting area of Joderell Bank, will be designed and built entirely by Indian scientists and engineers and is expected to be in operation within two years. A site for it has been selected after a very extended study as the axis of the telescope, which is 1,700 feet long, has to be parallel to the axis of the earth. Work on the site at Ooty has already started. It is proposed to make this radiotelescope one of the centres for inter-university work.

Returning to atomic energy, groups were established at the Institute to design and build all the electronics instrumentation without which atomic energy work is impossible. Thus, the Physics Division and the Electronics Division of the Atomic Energy Establishment at Trombay were both initially housed and built up in the Institute. The Electronics Group of the Atomic Energy Establishment has today a staff of over 1300 people and is the strongest research and development group in electronics in the whole country. There was a time when no less than 175 members of the staff of the Trombay Establishment were looked after by the Institute and the Institute has given some 46 members of its scientific staff to man the various divisions of the Atomic Energy Establishment, many of them in senior capacities.

May I now turn to the Atomic Energy Establishment at Trombay which is today by far the largest scientific centre in the country, with a total staff of some 8,000 persons, of whom nearly 1,800 are professional scientists and engineers and another 3,000 technical staff, many of whom, such as Scientific and Technical Assistants, are science graduates! This Establishment has again grown like the Institute, depending on the ability of the various groups to expand fruitfully. At no stage was an organisational chart drawn up projecting the future pattern of the Establishment. Only the broad lines of work were laid down and major projects considered and approved. Thus, within a broad overall policy, the maximum freedom was given tomembers of the staff to display initiative in picking fruitful lines of work and in developing new ideas. The emphasis has been throughout on developing know-how indigenously and on growing people able to tackle the tasks which lie ahead. The generation of self-confidence and the ability to engineer and execute industrial projects without foreign technical assistance, have been major objectives.

It was decided to build a reactor of the swimming pool type early in 1955. The basic design was frozen in July of that year and the entire reactor, including the building for it, was designed and built entirely by our own scientists and engineers in just over a year, only the fuel elements which contain enriched uranium being supplied by the United Kingdom Atomic Energy Authority. The reactor became critical for the first time on the 4th of August 1956 and was the first reactor in Asia outside any that the USSR may have had in its Asian territories. This reactor was designed and built by us at a time when most European countries, except of course the United Kingdom and France, were buying their first reactors from the United States. The successful completion of this reactor gave a great deal of confidence to our staff and was an invaluable facility around which the research and development of the project was built during the following few years. The control system for this reactor was built by the Electronics Division in some old wartime hutments on the site of the Tata Institute of Fundamental Research and gave trouble free operation for four years till the reactor was shut down in 1960 for overhaul, maintenance and repairs. At that time advantage was taken of the shut down to give it an improved control system and a comparison of the control rod drives and shut down mechanisms installed in 1961 with those originally installed, will show the advance that had been made by the Reactor Control Division in its engineering capabilities. The important fact remains however that the original control system, even if more cumbersome and less elegant, gave trouble free service for four years and the confidence gained in doing it oneself, fully justified the course that had been followed. It may also be remarked in passing that this reactor, built by our own people, was in operation two years before the first reactor in China, which was designed and built by the Soviet Union.

Having decided to build a reactor of the swimming pool type to beign with, we were looking around for a suitable design of reactor to carry out engineering experiments on the design of future power reactors, when we received an offer from the Canadian Government to build a reactor of the NRX type at Trombay. As this reactor suited our needs, the generous offer of the Canadian Government was accepted after some questions had been settled. The CIR reactor at Trombay is an almost identical copy of the NRX at Chalk River, but differs from it in one important particular, the primary cooling water circuit is a closed loop from which heat is removed by a secondary sea water circuit. The CIR being a Canadian gift under the Colombo Plan, all parts of it came from Canada, and the erection, though a Canadian responsibility, was carried out jointly with our staff. Although the total number of engineers and skilled artisans engaged on the construction of CIR rose at one stage to as many as 1,200, the maximum number of Canadian personnel at any given time at Trombay never exceeded 30. Indian welders had to be trained in the special welding techniques required, and all welds were radiographed. Similarly, Indian engineers participated in the erection of the reactor under overall Canadian supervision. I must say here in appreciation of the Canadian concept of this cooperation, that when the project was decided upon, they asked us to send some 40 scientists and engineers immediately to Chalk River to be trained in the operation and maintenance of the reactor, and it was most of these, as well as others, who were able to participate on return in the construction of CIR.

CIR has fuel elements made of natural uranium clad in aluminium alloy and it was decided to tackle the problem of making fuel elements in India from the very beginning. Accordingly, it was decided to set up a plant for making atomically pure uranium metal from uranium concentrate obtained from Indian monazite and other sources, and another plant for fabricating this uranium metal into finished fuel elements for CIR. In case any trouble arose during the initial operation of CIR, it was decided that half the first charge would be supplied by Canada and the other half made at Trombay, so as to be able to isolate trouble arising from the fuel elements from trouble arising from other sources. It was as well that this procedure was followed, because quite a number of difficulties were met in working up CIR to full power and it could be established that this difficulty did not arise from the Indian fuel elements, which from the beginning performed as well as the Canadian supplied ones.

The decision to build an uranium metal plant was taken in May, 1956, its construction was started in December 1957, and the first ingot of atomically pure uranium was produced in January 1959, the plant having been designed entirely by Indian scientists and engineers and built in about a year. Similarly, the fuel fabrication facility was also designed and built entirely by our own staff and produced the first fuel element in June 1959. The production of fuel elements is generally considered a rather difficult and tricky operation and the successful production of nuclear grade uranium metal and metallic fuel elements from it at a time when there were only about half a dozen countries in the world producing their own fuel elements added further to the self-confidence of our staff to undertake difficult tasks. The economics of the operation are also noteworthy. The capital investment in the uranium metal plant and the fuel fabrication facility together came to approximately Rs. 80 lakhs ($ 1.6 million) of which the foreign exchange component on industrial equipment, which had to be imported , was Rs. 32 lakhs (about $ 640,000). It costs us approximately Rs. 1.3 lakhs ($ 26,000) to convert uranium metal into a tonne of finished fuel element. Thus, even assuming a price of $ 10 per pound of uranium concentrate which is double the present market price, our fuel elements would cost Rs. 2.6 lakhs ($ 52,000) per tonne, or a single charge of 10 tonnes Rs. 26 lakhs ($ 520,000). This fuel charge, if imported, would cost $ 750,000. Thus, apart from the fact that we obtain our fuel elements at two thirds of the price at which we could buy them, the foreign exchange saving in one fuel charge alone, which in full operation is enough to keep CIR going for less than a year, more than compensates the total foreign exchange expenditure on setting up this plant. What is even more important, we now have first hand technical knowledge for the erection of such plants on a much bigger scale. Construction will be started this year on plants to make zircalloy from zircon, atomically pure uranium oxide from uranium concentrate and fuel elements for our two atomic power stations of 400 MW each which are being built in Rajasthan and Madras. These three plants together have already been designed by our own staff and will be built within two years. They are estimated to cost about Rs. 7.5 crores ($ 15 million). They will have enough capacity to fuel not only these two power stations, but those that will be built upto 1975, and by expansion later ones as well. However, the value of the fuel elements required by the Rajasthan and Madras stations alone will be Rs. 3 crores ($ 6 million) per annum and a recurring drain of foreign exchange to this extent on the import of fuel elements will be saved for the life of these two power stations as a result of building these three plants.

It was originally envisaged at the beginning of the Third Plan that we would have to start building an industrial scale plutonium plant to be completed by the end of the Fourth Plan for treating the used fuel from the nuclear power stations that would be in operation by then. In order to gain first hand experience of the technology of building a plutonium plant, which, as is well known, involves many special techniques, including the handling of very large amounts of radioactivity by complete remote control at the initial stages, and multiple precautions to avoid accidental criticality at the later stages, it was decided to build a pilot plant at Trombay to treat some 20 to 30 tonnes of used fuel per annum costing about Rs. 3.5 crores. The chemical data for the process was collected in our own laboratories in addition to what has already been published, and the plant was designed, engineered and built by our own staff and it successfully underwent trial runs in 1964. It has been in operation since last year. As it happens, the capacity of this plant (for the same cost) is many times larger than that originally planned, so that it has become possible to postpone the construction of the large plutonium plant. Secondly, the large plant was estimated to cost Rs. 14 crores, but on the basis of what we have learnt from the construction of the plant at Trombay, we now estimate that it would be possible to build an industrial plant of the same capacity for Rs. 10 crores, thus effecting a saving which is greater than the entire cost of the plant at Trombay. This shows the importance of undertaking research and development oneself, and that research and development, if properly carried out, effect more economies than they cost.

I have already mentioned the work of the Electronics Division. It is now proposed to set up an electronics plant in Hyderabad for the manufacture not only of the nuclear electronic instrumentation, including that which is required for routine production and use of isotopes in hospitals and industrial establishments and laboratories, as also the control systems of reactors, but a variety of electronic components and equipment, which the Trombay Establishment has been able to develop and which are required by the electronics industry generally, but are not yet produced in the country. Among these may be mentioned high quality carbon resistors, zener diodes, thermoelectric junctions, oscilloscopes and a variety of other components and equipment. An interesting example is also worth noting. While carbon resistors are being made by a couple of commercial firms in the country with foreign collaboration, these are of commercial grade and have not passed the stringent tests required for atomic or defence equipment. On the other hand, the carbon resistors developed entirely by our own efforts at Trombay have met these stringent defence specifications and will now be produced in quantity to meet the requirements of the country as a whole. If a more difficult variety of an object can be developed purely by indigenous scientific and technical effort, there is clearly no reason why a simpler variety of it should need foreign collaboration. The fact that foreign know-how had to be obtained for commercial grade resistors clearly emphasises the fact that the policy followed in setting up industrial enterprises has been misguided and much more self-reliance should and could have been aimed at.

There are many other examples of what might be called 'technological fallout' from our atomic energy programme which will benefit the industry generally. The Technical Physics Division has developed many different pieces of equipment needed for atomic work, which can be bought off the shelf in industrially advanced countries. The result is that we have been able to develop and make equipment needed in the country, which has nothing to do with atomic energy directly. For example, a result of developing the vacuum technology of oil diffusion pumps is that we have been able to make blood plasma freeze drying equipment on the one hand and other freeze drying equipment for food and pharmaceutical material on the other. There are a very large number of other examples of this type.

Additions to our scientific and engineering staff has been at the rate of between 150 and 250 per annum. To meet this requirement, the Atomic Energy Establishment in cooperation with the Tata Institute of Fundamental Research, has run a Training School in which about 150 persons have been admitted per annum on the basis of inviting applications from young men passing out of the universities every year and selecting the best of them. They are then given a year's lecture course and training in certain general as well as specialised scientific subjects. At the end of the year most of them are absorbed into the Establishment, the grading being on the basis of tests throughout the period of their study and an examination at the end of the year. To give an idea of the figures, last year about 3,400 applied with first and second class degrees from the universities, 251 were selected on the basis of an interview, 130 actually joined the School, and 125 completed the course and were appointed at the end of the year. On admission these young men become part of the small scientific groups working on specific problems, and at the end of two or three years they become very useful scientists. The best among them are likely to become the future leaders. We have found this method of recruitment very satisfactory, and although it has placed a heavy load on our senior staff by making the spectrum of our scientific staff much heavier at the junior levels than as it should be, it has provided a powerful source of able young scientists on the basis of which the programme can be expanded continuously in the future. It will be seen also that this method of building up our staff does not drain away senior persons from the universities, but on the contrary gives training, employment and opportunites to young graduates passing out of the universities.

To summarise, of the two ways of establishing science as a national activity in an underdeveloped country, the standard method on the one hand, and the alternative method of, what I have called, "growing science" on the other, the second seems to lead to better results in the end with greater potential for continuous growth. While it may seem much slower and harder at the beginning, it has the capacity for continuous growth and to develop the people it needs and its faster growth rate in later years more than compensates the slow beginning. Moreover, it may lead to concrete results sooner than the other method in developing countries, in which there is not a large pool of mature scientists to draw from.

I now turn to the problems of industrial development and the question as to whether a self-generating industry can be established without at the same time establishing a powerful scientific base. Indian industrial development has so far proceeded almost exclusively on the basis of setting up plants and industries with foreign collaboration. Our own experience makes it quite plain, however, that this method can never lead to a self-generating industry and without at the same time establishing a powerful scientific research and development effort to support it. A few examples will make this plain.

The steel industry has existed in India since the First World War, and one of the two steel plants was among the largest in the British Commonwealth in the early twenties. Yet, when these steel plants had to be expanded, it was necessary to draw upon foreign consultants and engineering firms to plan and carry out the expansion. When the Government decided to establish a steel plant in the public sector at Rourkela, a German consortium had to be asked to undertake the job. For the next steel plant at Bhilai the same course was followed, this time with Russian technical collaboration. The third public sector steel plant at Durgapur had similarly to be set up with the help of a British consortium, and essentially the same method is being followed with regard to the fourth public sector steel plant at Bokaro. Thus, the construction and operation of a number of steel plants has not automatically generated the ability to design and build new steel plants. Unless powerful scientific and engineering groups are established during the construction and operation of existing steel plants as a matter of deliberate policy, the dependence on foreign technical assistance will continue and the steel industry will not reach a stage of technical self-reliance. A similar situation exists in almost every other industry.

On the other hand, where a strong

scientific and technological base has already been laid, foreign collaboration can certainly lead to a quicker take-off. An example from the atomic field will make this clear. As I have already indicated, we have designed and built our own research reactors since 1955. However, when economic studies showed that in many areas of the country remote from the coalfields atomic power stations could be competitive with conventional station, we invited tenders on a world basis for the supply and erection of the nuclear power station at Tarapur, with only broad stipulations regarding its certain other technical requirements. The reason for this course is that no country has ventured to build a large power station of 400 MW without building first a prototype of 5 to 50 MW. The prototype takes as long to design and build as the large power station, so that if we had chosen to build our atomic power stations without external technical assistance, it would have taken us some four years, to develop and build a prototype and an other four years thereafter to build the full scale station. By resorting to foreign collaboration the first four years of this development have been eliminated.

The second atomic power station of 400 MW in Rajasthan is based on a Canadian design using natural uranium as fuel and heavy water as moderator and coolant. As a result of CIR, this is a type of reactor of which we have already considerable experience. This time the Department of Atomic Energy has undertaken the prime responsibility for constructing the station but with the assistance of Atomic Energy of Canada Limited and a Canadian engineering firm as consultants. The third atomic power station at Madras, which will be of the same size and of the same basic design, will be built entirely by Indian scientists and engineers without any foreign consultancy. This clearly demonstrates that the result of having built up a very strong research and development organisation with associated engineering skills is that we have been able to profit from the foreign collaboration to "buy" ; some four to five years of time and to make ourselves self-reliant even in the design and construction of large atomic power stations.

The relative roles of indigenous science and technology and foreign collaboration can be highlighted through an analogy. Indigenous science and technology plays the part of an engine in an aircraft, while foreign collaboration can play the part of a booster. A booster in the form of foreign collaboration can give a plane an assisted take-off, but it will be incapable of independent flight unless it is powered by engines of its own. If Indian industry is to take-off and be capable of independent flight, it must be powered by science and technology based in the country.

Disappointment is some times expressed at the small return that has come from our investment in science and technology in the country. It should be realised first that scientific and technological development on a broad basis involves the development of a large number of scientists and technologists and the maturing of many of them. This is a process which must inevitably take 15 to 20 years. It is only today that our investment in science and technology has reached the stage of being able to make returns. The recent stoppage of foreign aid has shown our tremendous foreign dependence on a vast variety of materials and equipment, many of which could and should have been produced in the country long before this. We have found that a very large number of them can be produced as a result of the know-how which already exists in scientific organisations here, and steps are being taken to produce these in the country without foreign assistance. The results will show themselves within the next few years, and I have no doubt that the confidence which Indian technologists will gain thereby will spread to Indian industrialists and administrators, many of whom, not having any basis for technical judgements of their own, are inclined to play safe by relying on foreign consultancy. Many examples can be given of foreign collaboration resulting in badly engineered plants or technical mistakes, and when such technical mistakes are corrected the foreign consultant benefits from the experience. Whereas, if an Indian scientific or engineering organisation had been employed, the experience gained even from initial failures would have been a gain to the country. The Soviet Union did not hesitate to follow this path. One should also remember that in buying foreign know-how one is paying for an element which covers the cost of research and development done by the foreign consultant, and it is clear; that a more permanent benefit would result to the country if this money were made available for supporting research and development in India.

There is one final point I would like to touch on, and that is the role of administration in science. It is thought by many that we are reasonably advanced in administration but backward in science and technology. This statement is misleading. We have fortunately inherited extremely competent administrative services capable of dealing with all types of administration which had to be dealt with before Independence in what was intended to be a static and underdeveloped economy. Consequently experience of the type of administration needed for industry and for science and technology has been lacking. The type of administration required for the growth of science and technology is quite different from the type of administration required for the operation of industrial enterprises, and both of these are again quite different from the type of administration required for such matters as the preservation of law and order, administration of justice, finance, and so on. It is my personal view, which is shared by many eminent foreign scientists, that the general absence of the proper administrative set-up for science is a bigger obstacle to the rapid growth of science and technology than the paucity of scientists and technologists, because a majority of the scientists and technolgists we have, are made less effective through the lack of the right type of administrative support. The administration of scientific research and development is an even more subtle matter than the administration of industrial enterprises, and I am convinced that it cannot be done on the basis of borrowed knowledge. It must necessarily be done, as in the technologically advanced countries, by scientists and technologists themselves.

SCIENCE IN INDIA

Presidential Address

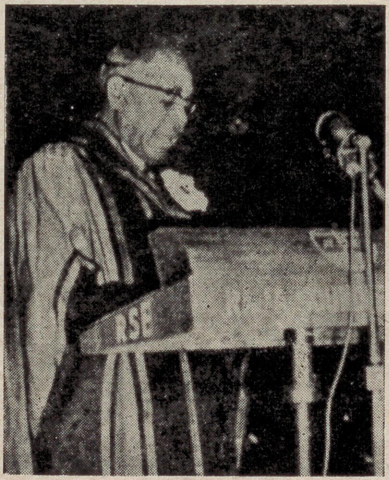
at

Fiftythird Indian Science Congress held at Chandigarh in 1966

by DR. B. N. PRASAD

I feel greatly honoured to have been called upon to preside over this 53rd Session of the Indian Science Congress and I should like to express my sincere thanks to my scientist colleagues for my election to this exalted office. Following the usual convention, I shall be availing of this opportunity to present before you a brief survey of the recent researches that have been done in a specialised field of work with which of late, myself and my pupils have been intimately associated. I am also utilising this occasion of sharing my thoughts and hopes with this august assembly regarding the advancement of Science and scientific research in India.

There was a time when science was the pre-occupation of lone scientists trying to unravel the mysteries of nature. Their



Prof. B. N. Prasad, M.Sc. (Banaras), Ph.D. (Liverpool), Dr. es.Sc. (Paris), F.N.I., F.N.A. Sc., General President, Indian Science Congress (1965) passed away on January 18, 1966. In the death of Dr. Prasad, the country has lost an eminent educationist and scholar of international fame. Born in 1899, Dr. Prasad received his earlier education at several places including Allahabad and Patna. After obtaining his M.Sc. from Banaras, he joined Banaras Hindu University and two years later shifted to Allahabad University where he worked till his retirement in 1961, as Professor and Head of the Department of Mathematics. In 1931, he took Ph.D. from Liverpool University and in 1932, Doctorate from Paris University. Prof. Prasad had worked on pure mathematics particularly in the field of Analysis, Theory of functions, Fourier Series, Conjugate Series and Dirichlet Series and contributed a large number of research papers mostly in foreign journals. He was the Founder and President of the Allahabad Mathematical Society, which publishes "Indian Journal of Mathematics". Prof. Prasad had represented India and Indian Science Congress several times at international conferences.

In recognition of his contribution to the cause of science and education, he was awarded Padma Bhushan in 1963 and was nominated Member of Rajya Sabha in 1964.

purpose possibly had been to derive ethereal sense of pleasure by contributing in some measure towards the intellectual growth of mankind. Recent past has brought about revolutionary change in the scientific outlook of the people, specially after realising that nature is a great source of power, and it is science alone that can assist in placing that power in the hands of man for promoting the human welfare. Science today has developed a very real and concrete objective, the objective of human progress, prosperity and well-being. Science, technology and inventions are now rightly regarded as the most important means for improving the material welfare of the people. The agency of science as a major force of social reconstruction now stands universally accepted. It is no wonder, therefore, that the scientific development of a country becomes the yard-stick of its progress and greatness.

Realising fully the paramount importance of science and technology in the reconstruction of modern India, the Government of India gave attention to its development immediately after the attainment of Independence. A separate portfolio for scientific research was created at the Centre on the very day of the advent of Freedom to India, and was placed under the direct charge of the late Prime Minister, Jawaharlal Nehru, who through his vision and faith in science did so much to promote the scientific development in the country. The Department of Scientific Research was established in June, 1948, and three years later a full-fledged Ministry of Natural Resources and Scientific Research was created. The spirit and enthusiasm of the people in India for scientific pursuits received great stimulus when a very comprehensive resolution, known as the Scientific Policy Resolution, was brought forth in 1958 in the Parliament embodying the considered scientific policy of the Government of India. Thus, this Scientific Policy Resolution demonstrated both a declaration of faith in science and technology and an instrument of national progress as well as a directive for specific steps to be taken.

In pursuance of this Policy a large number of scientific and technological activities have sprung up in the country. A chain of National Laboratories has been set up by the Council of Scientific and Industrial Research all over the country for doing fundamental and applied research in the field of science and industry. These laboratories provide facilities for team work which is so essential these days to carry on investigations of substantial character. Numerous research institutes have come into existence which deal with specific problems of agriculture, medicine, engineering, fuel, power etc. etc. The Atomic Energy Commission was set up to develop atomic energy for peaceful purposes.

In 1956 was set up the University Grants Commission by an Act of the Parliament to look after higher education and research in universities. An important function of the Commission is to take suitable steps for the co-ordination, improvement and raising of the quality and standard of higher education and research in our universities. The Commission has been giving good consideration to help and finance universities in the matter of scientific equipments, libraries, and award of research fellowships. It has established a number of Centres of Advanced Study with the object to encourage the pursuit of excellence and to improve quality and raise standards at the post-graduate and research levels.

The main objective of all these scientific activities sponsored by the Government is apparently to achieve high standard of scientific and technological developments which are ultimately expected to raise the efficiency and output of industry and thereby enhance the welfare of the people. There being, here and there, some sorts of misgivings, it may not be out of place to consider carefully if the desired degree of success has been achieved. Exceptions apart, is the general level of our scientific and technological output favourably comparable with that of some of the advanced countries of the west? Are all these efforts and financial investments assigned to these undertakings, yielding reasonably high returns? Is our scientific machinery correctly geared cent per cent? Is the ladder to climb to the heights of our scientific and technological objectives firmly based on the ground?

For accomplishing our task successfully, it is necessary to give due attention to all the aspects of researches—pure, applied and developmental. Essentially these are inseparably inter-connected and one generates the other. But the starting point for all these is a sound scientific training and researches in pure sciences, often termed as fundamental researches. Having remained for more than four decades in intimate contact with this aspect of researches, I may be permitted to make some observations to improve the state of affairs in the training and preparation of our scientific personnel.

It is the universities which form the main source from which emanate young men and women who after completing their post-graduate studies may take to advanced study and research in different branches of various sciences. It is, therefore, of foremost importance that the universities should be highly efficient and run on proper lines. Apart from modern equipment, library etc., it is necessary that the universities should have right type of Vice-Chancellors and highly qualified staff. For Vice-Chancellorship only those persons should be selected who have got an established reputation of eminent scholarship, breadth of vision, administrative ability, missionary spirit, freedom from the so-called university politics and a deep conviction in the importance of scientific research and technical development for the country.

Regarding the selection of Professors, it may be suggested that the Professor, who has to be responsible for the organisation of teaching and research in his Department, should be selected very carefully on an All-India basis. He should be an eminent scholar abreast with modern trends in his subject, a distinguished researcher of high order and one who can inspire his colleagues and pupils in scientific research. The other teachers also should be selected on an All-India basis and should be such as have done researches themselves and are capable of guiding and inspiring young students to take to the profession of teaching and research. To ensure that teachers continue their research activities even after their appointment on the staff, an efficiency bar should be imposed at suitable intervals. For promotion to higher posts and grades, the merit and claims of a scientist or a university teacher should be judged not only on the basis of his own publications but also by the kind of students trained and inspired by him and the work published by his students. Care should be taken that no fresh M.A. or M.Sc., however bright his examination result might have been, should be appointed to teach degree and post-graduate classes unless and until he has devoted a period of at least two years, after taking his Master's degree, to advanced studies and research. While it is customary for a young man who enters any other type of service or profession to undergo a rigorous training to enable him to do his job efficiently, it is rather strange that in India, universities are the only place where young men, immediately, after passing the Master's degree examination, are employed at once to teach even the post-graduate classes. The result of this is not very happy. In order to overcome this difficulty, it is, therefore, very necessary that institutes of the type of *Ecole Normale Superieur* of Paris be established in the country. Staffed by scientists of the highest strata in the country, these institutes may also engage on suitable terms distinguished scientists from abroad. Fresh postgraduates wishing to take up a career of teaching and research should be admitted to these institutes for being trained into advanced courses of studies and research for a period of at least two years to become well-equipped for teaching university classes.

It will not be out of place to mention here that the great rapidity, with which the number of universities is multiplying in India every year, must be reasonably checked. On account of this rapid increase, it is not being found possible for the new universities to get efficient and qualified staff in sufficient number and to equip their laboratories properly, with the result that the teachers are unable to keep pace with the trend of the latest developments and the knowledge they impart to the students, becomes rather shallow and is generally not conducive to create interest and enthusiasm among them.

It is well known that teaching and research flourish best in co-ordination. In order that the atmosphere in any department be congenial for this purpose, it is essential to avoid two categories of staff in the universities—one teaching and the other non-teaching—since such a state widens the gap between the research scholars and the teachers. The assignment of some teaching work to research scholars and the insistence on carrying on research by teachers would bridge this gap. But there are several difficulties involved in this. In most of the universities a teacher, even at the post-graduate level, is burdened with such a heavy amount of routine teaching that the leisure at his disposal is not enough even for the satisfactory preparation of his teaching responsibilities, not to mention of creative research.

Among the brighter students there is still a reluctance or lack of enthusiasm to take to research career. It is due to several factors. More often than not, the real researcher is tragically ignored, and it is not surprising to find the genuinely devoted researcher who normally spends a number of years after his graduation in the pursuit of knowledge, placed behind the plodder, thereby losing not only claims to seniority but, what is worse, even the usual incremental rise in salary. The feeling of insecurity of getting a suitable job in keeping with his qualifications keeps hanging on him.

In view of these difficulties, suitable steps, for attracting brilliant young men and women to scientific research career, may be considered, such as:

(i) Initially a large number of brilliant students, after they have obtained the Master's degree, may be given handsome research fellowships comparable to the salary they would have got on their appointment as University Lecturers or administrative officers. There ought to be an assurance that should their work prove satisfactory, they will be absorbed in permanent assignment. This will serve to attract them to take up Research Fellowships in preference to taking teaching or other jobs.

(ii) After some time, say every three years, the work of these Research Fellows should be looked into and those who show outstanding capacity for research may be awarded emoluments comparable to that of a University Reader and later on of a University Professor, in case they be found specially dedicated to research for life.

(iii) When a Research Fellow joins a teaching post, the period spent by him in research should be given due recognition while his initial salary is being fixed.

(iv) A very useful step will be that brilliant researchers upto a certain age, say 40 years, be not allowed, either by a rule or convention, to get elected to many committees and become 'Committee Men', except those in which the use of their very specialized knowledge of the subject is required.

The constituting of a Scientists' Pool by the Ministry of Education of the Government of India to prevent young scientists returning from abroad from feeling stranded, though a laudable one in spirit, is unfortunately proving yet another source of discouragement to the researchers working in India. Although theoretically, persons with Indian qualifications are also eligible to this Pool, but for all practical purposes the selection is limited to those returning from abroad. There are several points in this connection which need be considered very carefully. With certain exceptions, those who have been trained abroad do not seem to be in any way superior to those trained in India. So, in the first place, this Pool arrangement places a premium on a foreign doctorate and continues to draw people away from the country even in such cases in which proper facilities exist in our own universities. It is a matter of common experience that the best students at present immediately receive a Fellowship within the country and remain in India. Others who fail to get these, look for one from outside the country, particularly from the U.S.A. But on return these latter ones receive in the Pool Rs. 600/- or so per month, while those working in India, even if potentially more capable, are given only Rs. 400/- per month as a Post-doctoral Fellowship. It may, therefore, be suggested that while a Pool post must be available for persons immediately on returning from abroad, it may be provided for a limited period, say one year, and its value should normally be not higher than that of the post-doctoral fellowships given generally in India.

Of late, there has been a craze among young research workers, and even among some of the older persons in India to go abroad for advanced studies and research even in subjects in which ample facilities exist in the country. A good number of these scientists is at present working abroad. Some of them prefer to stay abroad for personal reasons; but quite a substantial number of them do not propose to return to India on various justifiable and unjustifiable grounds like:

(i) lack of facilities for employment in the country,

(ii) lack of facilities and opportunities for continuing the work they started abroad,

(iii) payment of lower salaries than what a foreign government could offer to them,

(iv) apathy of the Government towards starting research projects in the universities,

(v) distrust in Heads of Departments, both in the universities and in the Government institutions, in matter of allotment of funds and recruitment of scientific personnel,

(vi) having foreign wives, etc.

The situation can be met with by giving careful consideration to the matter. First of all, efforts should be made to persuade those settled abroad to come back to India and reasonable working facilities and prospects be offered to them. Also as a rule younger people should not be allowed to proceed to foreign countries for research work upto the doctorate standard in subjects in which facilities for research exist in India. Even in cases of people wishing to go abroad for post-doctoral research, passports should be issued for limited periods and normally not for a period longer than that prescribed for a particular course. Since individual freedom has got to be consistent with national requirements, understanding on a diplomatic level may be reached with the country concerned to discourage the Research Fellow going there to take up an appointment or marry a foreign wife. The main criteria for permission to go abroad should be the non-availability of the facility for working out any specific problem in the country and the importance of the problem from the point of view of national interest; but before doing so, efforts should be made to see if it would not be worthwhile arranging for the facilities to be provided in the country itself instead of allowing the student to go abroad.

Bearing in mind that, with certain exceptions, those trained in foreign countries are not necessarily superior to those trained in our own, we really need not feel much worried over the so-called 'Brain-drain' from India, which is not at all as serious as is generally feared. It is not only from India that people have migrated and settled abroad, but it is also from countries like England, France, Germany, Russia, etc., that for various reasons scientists have migrated to various other countries, specially to the U.S.A. It is high time that we give up being fetish about the degrees obtained in foreign countries. Science is international and a good piece of research done anywhere in the world should be considered equally creditable.

I would like to give special emphasis to a certain suggestion. Just as the Government has been launching different projects costing crores of rupees, it is worthwhile launching a project in this direction also. It may be suggested that a number of high-rank institutes for Advanced Studies and Research be set up in different regions of the country. Instead of allowing our young researchers to go abroad, we may invite eminent scientists from abroad to come and join these institutes on a contract basis and train our researchers. This should be done on a very elaborate and magnificent scale and the selection of eminent scientists to be invited from abroad to join these Institutes should be made in a very careful manner, so that with their help and co-operation, it may become possible to produce, in a few years, a large band of bright young men and women fully qualified to teach in universities various modern scientific subjects. With the goodwill that India enjoys in different countries of the world, our fellow scientists from abroad will be quite willing to help us in this matter. If this could be done, we shall be able to prevent the younger people almost completely from going abroad to study for a research degree. We shall, through such a project, not only save a good deal of foreign exchange, but shall also, in years to come, find that people trained on right lines under Indian conditions will be much more useful to the country.

I must emphasize, however, that we should not be against sending our scientists abroad. On the other hand, once they get trained in some field and gain a little maturity, they may be permitted to go abroad, off and on, for coming in contact with fellow workers and for exchange of ideas and broadening of outlook.

Further, if we, as a policy, decide not to give any preferential treatment to a person simply because he has obtained his degree from a foreign country, and base his financial claims and prospects entirely on his research merit, whether acquired in India or abroad, the craze among a large number of young people to go abroad, will subside.

The financial prospects of a scientist, who sticks to teaching and research in a University, are not sufficiently attractive when compared with those who take up administrative jobs, or some other technical profession or join research institutes. On account of this, qualified professors are migrating in large numbers from universities to these Institutes, Laboratories and Industries. To describe this state of deterioration of universities on account of migration of well-trained scientific personnel to Research Institutes and Industry for the sake of higher salaries, I feel tempted to quote here a few lines from an address of Ambassador Chester Bowles delivered recently to the Parliamentary Scientific Committee:

"Recently the President's Advisory Council on Education warned that unless enough of the nation's ablest man-power is reinvested in the educational enterprise, its human resources will remain underdeveloped and specialized man-power shortages in every field will be compounded..... Our nation, like the prodigal farmer, is consuming the seed corn needed for future harvests".

Large amount of money is naturally needed for the proper execution of modern elaborate plans of scientific and technological researches. Unfortunately the funds allotted for this purpose by the Government are very meagre and insufficient and seem almost negligible when we look at the figures available in scientifically advanced countries. The amount that is now spent on research and development by the United States Government comes to 18 billion dollars or nearly 20 per cent of its annual budget in comparison with only 2 per cent in 1945, while another 5 billions become available each year from private industry and the non-profit foundations to be spent for this purpose. The U.S.S.R. is equally thoughtful and enthusiastic in allocating a very substantial percentage of its national income on scientific and technological developments. Other advanced countries are following more or less the same pattern on such expenditure. The sense of feeling of disappointment of scientific workers in this country can be easily realized when we are given to understand that so far even 1 per cent of the National Income is not assigned for this purpose. It is, therefore, high time that Government should realize the necessity of raising substantially the amount of money for scientific and technological developments.

Our country has now entered the 19th year of her political independence, and today, thanks to the zealous efforts of our national leaders, India occupies a respectable position in the Comity of Nations. But as we all know, political freedom by itself is not enough, we have to be independent also in the items of food, defence, medicine and various other essential requirements of life, the acquisition of which all depends on the proper applications of science and technology. We have marched ahead, but we should be also fully conscious of the distance we have yet to cover and the tasks we have yet to accomplish if we aspire to acquire for our Republic a position in the scientific world, compatible and in keeping with our rising prestige in the international sphere.

ASWI ACTIVITIES

The first meeting of the Organising Committee for the Symposium on 'Collaboration between the Countries of Africa and Asia for the Promotion and Utilization of Science and Technology' was held in New Delhi on 22nd November, 1965, under the Chairmanship of Dr. Zakir Husain, Vice-President of India.

The meeting was attended by 32 members of the Organising Committee and the following had sent letters regretting inability to attend due to previous engagements :

1. Dr. H. J. Bhabha.
2. Dr. M.S. Randhawa.
3. Dr. M.S. Iyengar.
4. Dr. N.B. Prasad.
5. Shri Y.A. Fazalbhoy.
6. Dr. S.P. Ray Choudhuri.
7. Dr. K.L. Wij.
8. Dr. Satish Dhawan.

Dr. N.P. Gupta, President, A.S.W.I., welcomed the Vice-President and described in brief the genesis of the Symposium. He said that overseas participants in the Symposium on 'Science and the Nation in the Third Five Year Plan' held in New Delhi in July, 1964, met in Delhi after a visit of the scientific and industrial centres in India and decided to hold a Symposium to discuss the ways and means in which scientists in developing Countries in Asia and Africa could cooperate for in the utilisation of science and technology. It was agreed that the Symposium be held in New Delhi in the winter of 1965-66. The meeting also appointed a Preparatory Committee with representatives of 10 countries and Dr. S. Husain Zaheer was elected Convener of the Preparatory Committee. The Association of Scientific Workers of India offered to be the host to the Symposium and this was accepted. It was further agreed that A.S.W.I. will make all technical arrangements for the Symposium. The Preparatory Committee held its first meeting in Cairo in April, 1965. Dr. S. Husain Zaheer, Chairman of the Preparatory Committee, thanked the Vice-President, Dr. Zakir Husain for kindly agreeing to become the Chairman of the Organising Committee. He said that India had made considerable headway in the field of science and technology and she would like to share her experience with her neighbours in Asia and Africa. The response from the African and Asian Countries in the last Symposium on 'Science and the Nation' was very encouraging. That is why this symposium was being held to bring about collaboration between developing countries. Invitations had been issued to many institutions, individual scientists and various international bodies.

Shri A. Rahman, General Secretary (International Relations), while presenting the general report on the progress of the Symposium, made a porposal that in addition to inviting fraternal delegates from U.N. bodies, World Federation of Scientific Workers observers from other countries, who expressed their keenness, might also be invited to attend. He also said that a brochure giving a Bird's eye view of the scientific development in India should be brought out.

Dr. S.K. Roy, General Secretary (Organisation) reported on financial estimates for the

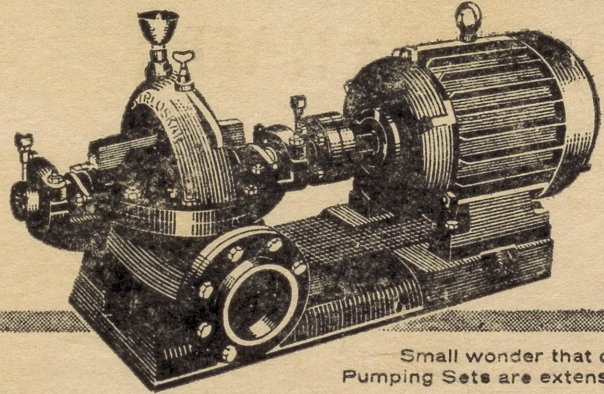
Symposium. He mentioned that A.S.W.I. had requested the Government of India for a grant of about Rs. 13 lakhs against which a grant of Rs. 4 lakhs had been sanctioned. He stressed the need for a further grant of at least Rs. 5 lakhs to meet the expenses of the Symposium. Then a discussion was held on finding the ways and means to augment the financial resources of the Association.

The following were elected the Conveners of the Sub-Committees noted against their names:

Convener	*Committee*
1. Shri A.K. Bose	Accommodation
2. Shri N. Jayaraman	Transport
3. Dr. V.S. Nair	Publicity, Reception
4. Shri R.D. Taneja	Hall Arrangements
5. Shri K. Kashyapa	Publications
6. Shri J.M. Dutta	Finance
7. Shri S. Dutta	Itinerary, Volunteers etc.
8. Shri A. Rahman	Organising of Participation
9. Shri N. Sen	Cultural Programme
10. Shri S. Bhattacharya	Enrolment of Members
11. Shri Baldev Singh	Recorder

In his concluding remarks, Dr. Zakir Husain said that a Symposium of this nature was of great significance internationally. He stressed the need for greater collaboration amongst scientists of the developing countries for the good of the people. He expressed the hope that everything would be done to make the Symposium a complete success.

In proposing a vote of thanks to the Chair, Shri Baldev Singh expressed the gratitude of the A.S.W.I. to Dr. Zakir Husain for very kindly consenting to be the Chairman of the Organising Committee and expressed the hope that under his able guidance, the Committee would perform its duties commendably.



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V. K. Declares 'State of Emergency'

Friends and Comrades!

We declare a 'State of Emergency' in respect of our finances. Unless energetic measures are taken, there will be a breakdown in our system of things. We and our colleagues in the ASWI leadership have been fighting shy of facing realities—as if we could dream away the ghost of disaster. Now reality stares us in the face.

We are publishing nearly two thousand copies for free supply to our members, advertisers and giving complimentary copies to important citizens. Our expenditure per issue exceeds Rs. 1500. Against a membership charge of Rs. 5/-, each enrolled member gets 12 issues costing Rs. 12/- or so. Against our total annual expenditure of Rs. 19,000, we collect advertisement revenue worth Rs.4,500, get subscriptions worth about Rs. 500 and end up with a deficit of Rs. 14,000. We have been receiving and have again applied for a government grant which is a great help. But we must show a greater degree of self-dependence even to deserve official support.

Out of the membership subscription of Rs. 5 from its 1700 members, the central office may get about Rs. 3800 as its share. With this we have to run the office and even defray travel expenditure to the Council members—which wipes out this income also. No wonder, we find ourselves on the verge of bankruptcy.

We are taking emergent measures, trimming off expenditure, effect further economy —conducting a drive to get advertisements and requesting the Council to raise the membership subscription so as to at least cover the charges for regular free supply of V.K.

V.K. is your voice and defender of your rights and privileges. It fights the battle for a scientific attitude and temper in our social life against obscurantism, revivalism, bigotry, superstition and anti-scientific beliefs and practices. It fights for national self-reliance on the basis of science and technology. V.K. deserves to survive and grow strong.

We appeal to every member and branch to appreciate the gravity of the situation and send to us their individual and collective contribution by way of donations to tide over the crisis.

—Editor

Editorial

INFORMATION SCIENTISTS IN THE CSIR

It is easier to make a discovery today, says Professor Bernal, than to find out whether it has already been made. The phenomenal progress in research and development in science and technology during recent decades has led to a varitable 'information explosion'. The laboratory scientists find it impossible to digest all the material published even in their own fields of narrow specialisation, not to speak of allied areas. At the same time the cost of research is rising so sharply that economy is of the utmost importance, especially in the emerging countries. The time and talent of the research workers have to be marshalled to ensure maximum productivity.

The complexity of the problem has led to a division of labour and the gradual emergence of a new class of specialists called the Information Scientists. Scientists in their own right, they specialise in the location, abstraction, documentation and dissemination of technical information. They play an increasingly vital role in the promotion of research and the prevention of waste by the provision of valuable date. The technician who produces the warhead is no less important than the warrior who wields it.

The Council of Scientific and Industrial Research which has a net-work of laboratories all over the country, has a number of organisations specialising in various important aspects of information. Some of them are the Indian National Scientific Documentation Centre, Publications & Information Directorate, Directorate of Research Coordination and Industrial Liaison, Research Survey and Planning Organisation and the Directorate of Scientific & Technical Personnel. Every laboratory has also a nucleus of Information Scientists, competent to make a special contribution to the work of the Laboratory and share the labour of scientific achievement.

There was no distinction between scientists working in the laboratories and in the libraries. But, in the implementation of the last Pay Commission's recommendations (1959) certain discriminations were introduced in the pay scales, and service conditions, adversely affecting the Information Scientists. Technical officers were given a slightly inferior grade than Scientific Officers. Information Scientists were classed as Technical Officers and not Scientists. In an era when caste and class distinctions are disappearing, this division of research staff into scientific and technical led to considerable unhappiness.

These discriminations were the subject of considerable discussions in meetings of the Association of Scientific Workers of India and other bodies.

The discrimination was ultimately removed by the decision of the Governing Body of the C.S.I.R. which met on March 24, 1964. The heirarchy in the scientific ladder has also been greatly reduced. Positive contribution is sought to be rated higher than positional attributes.

The impact of decisions depends upon the implementation. Since the method of fixation was not specifically stated, the salaries were fixed at the stage *next below* the present pay and the balance of pay (to be treated as special pay) is to be absorbed in subsequent increments. The actual benefit from the decision has thus been put off in most cases by several years. Although it looks strange, in certain cases persons with greater seniority and salary will before long get lower emoluments than their juniors.

It may be pointed out that in the case of the Life Insurance Corporation and certain other organisations, the refixation of salary is to be done at the stage *next above* the salary of the person, not *next below* as in the case of C.S.I.R. Scientists. In the case of the State Bank of India employees numbering over 30,000, every employee is assured of some immediate benefits in addition to better pay scales.

It may be a case of the Information Scientists being ill-informed about administrative niceties. The present situation has arisen because the decision of the Governing Body has been implemented only in letter, not in spirit. We are sure that the farsighted, sympathetic and competent hands that guide the destinies of Scientific and Industrial Research in this country will fully appreciate the present position and take positive steps to rectify the injustice that has taken place.

Frankly Speaking

HALF-BAKED PROCESSES

Nothing has done more harm to the good name of some of the research institutes in the country than the incomplete and half-baked processes and projects passed on to industrial firms. In some cases the scientists and technologists concerned—some of them eminent and outstanding—were themselves not even aware of the basic requirements of technical and economic data. Others talk of imparting laboratory stage know-how on 'as is' basis which would be understandable in the context of advanced countries like U.S.A. and West Germany. They expect the industrial firms to have a look at their laboratory experiments or improvised pilot plants and then be able to do it at an industrial scale on their own. If the firms refuse to be 'taken in' and press for well-tried processes from abroad—they set up the argument of indigenous know-how being ignored or bypassed. If some small scale or enthusiastic entrepreneur inspired by patriotic sense, purchases a process, he gets the real taste. The scientists and technologists are just not available to share his burden—important meetings, deputations to conferences, more urgent national research tasks engage their attention. They are scientists, the cream of society—what have they to do with the mundane task of making money or dirtying their hands in non-creative industrial operations. Months and years pass while experimentation is still going on —giving 'encouraging results and promising data' but no proper project report on which to base his industry.

Talk of indigenous know-how is started long before it is anywhere near the application stage. Specifications and test methods of raw materials and finished products, detailed process data, design of plant and equipment, its availability and cost, tentative lay-out, location of factory, problems of effluents and the economic and technical feasibility are just not thought out. At times process know-how is declared available and parties advised to import the entire plant from firms abroad who would in any case be too glad to supply plant and equipment with know-how thrown in free of cost. The lure of publicity to their individual names and those of their institutes so befogs their outlook that its deleterious aspects are missed. How long can these scientists and technologists deceive themselves and others with half-baked processes in the name of Indian know-how!—or are they so profoundly ignorant that they don't even know of the inadequacy of the know-how that they seek to be industrially utilised.

Indeed there are honourable exceptions; but unless these exceptions multiply fast enough as to become the rule—the entire future of indigenous know-how and the national policy of self-dependence is at stake. In Pakistan, the PCSIR insists that no laboratory process should go out which has not been run on a production basis by the laboratory itself. It need not make a profit but all 'production data' should be available. May be India being better

(*Contd. on page 12*)

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HOW BRITAIN DID IT

M. S. Iyengar*

1.1 Introduction

Few people are aware of the prodigious efforts and heavy sacrifices that the British people made to win the victory in war of 1940-45. In the early summer of 1940, most of Britain's small and painfully built up stocks of military equipment lay burnt or captured in Belgium. The British people, almost unarmed, isolated by the collapse of the Continental allies, their sea life-lines cut off by enemy action, still with an economy which was not really geared for war, accepted the challenge of facing a fully mobilized Germany.

1.2 National Income: War efforts

In 1938, only 6 per cent of the British national income was devoted to defence expenditure and the next year it rose to 14%. During the early summer of 1940 nearly 20 per cent of Britain's economy was mobilized for war. Four years later when the magnificently equipped forces recrossed the Channel; 55 per cent of a greatly increased national income was applied directly to the war efforts.

1.3 Stringent Control measures

The civilian consumption was strictly controlled. All luxuries disappeared. Cars and motor-cycles, radio sets, refrigerators, silk stockings, leather boots, vacuum cleaners and watches, all these things were simply not to be had or not made. Food itself suffered along with the rest. All luxury foods disappeared. Rationing saw to it that many of the more ordinary foods were eaten only in a strictly necessary and austere measure. The consumption of fresh eggs per head per week was reduced from 3 to 1, fresh meat from 30 ounces to 22 ounces, sugar from 31 ounces to 20 ounces. Imports were cut down as far as they could be. There was a cut from 40 million tons per annum before the war to as little as 23 million tons in 1942. Food and animal feed were cut to half the per-war time.

Iron ore was cut down, to use the home sources, by over 3 million tons, timber and wood pulp by over 9 million tons. Exports too were deliberately curtailed to less than one-third of their pre-war level.

Despite these difficulties, despite the blitz and the consequent dispersal of production and the sinking of supply ships by the U-boats, the production of munition increased by 4-7 times the pre-war level. For instance, the production of tanks rose from 1,200 to 8,600, aero engines from 18,000 to 63,000, machine guns from 29,000 to 105,000. Production of iron ore rose from a pre-war average of 12.4 million tons to a war peak of 19.4 million tons, aluminium from 18,000 tons to 56,000 tons and magnesium from 2,000 tons to 23,000 tons. Of all the munition used by the Armed Forces of the British Commonwealth and Empire (8$\frac{3}{4}$ million men in all), since the beginning of the war, about 70 per cent were produced in the U.K.

1.4 How Britain did this and what steps it had adopted to meet the challenge ? The answers to these should be of interest to us during this National Emergency.

*Director, Regional Research Laboratory, Jorhat, Assam.

2 Control of Raw materials

2.1 An elaborate and comprehensive system of Government controls was enforced on the procurement and use of raw materials by the industry. The raw materials included steel, non-ferrous metals, timber, industrial alcohol, fertilizers, industrial ammonia, sulphuric acid, silk and rayon, wool, leather, cement, paper, oil, coal, coal-tar adhesives, plastics and a wide variety of chemicals like dimethoxyl diphenylamine.

3 Salvage of waste materials

3.1 Intensive salvaging of commodities became another form of home production. It was made illegal to throw away even a bus ticket and upto V day 4.2 million tons of waste paper had been delivered to paper mills for re-pulping. Rubber was reclaimed from the tyres, and tin pressed and re-tinned. Iron railings along the public parks and private frontage were requisitioned to the weight of 6,00,000 tons.

3.2 During the war, a special Industrial Salvage Group Scheme was organised by the Ministry of Supply. Under this scheme, the industrial enterprises of a given area could form themselves into a group for the purpose of promoting the recovery of their waste arisings and putting them to the best uses.

3.3 Although under no kind of obligation to participate in the scheme, firms numbering about 10,000 did co-operate and 300 groups were formed. The members of each group pooled and exchanged their ideas and the results of their research. They made known their individual shortages and it often happened that waste material of one industry provided raw materials required by another.

3.4 If a firm had a waste material for which neither the firm nor the group knew a suitable use, advice of the Department of Scientific and Industrial Research was sought and in this way the resources of the Government Departments and their associated organizations were mobilized. Many striking and even romantic examples of the utilization of wastes can be given. A public utility concern had thousands of tons of coal-dust for which no use had been found. Within a month of joining the groups, the concern was sending off the coal-dust to another firm which used it for heating boilers.

3.5 Waste liquor from aircraft factories, instead of polluting rivers was drawn off by a power pump, into a visiting tanker, and after scientific treatment, was converted into chrome sulphate for use in the tanning of leather for boots and shoes.

3.6 Used photographic films yielded important raw materials. The silver was recovered for instrument components, and the cellulose was used again for making leather cloth, stiffenings for shoes and as a substitute for rubber water-proofing.

3.7 Saw dust was used in the production of phenolic plastics and resin boards and also for the manufacture of industrial alcohol, bricks and tiles.

4. Steel

4.1 The steel Industry abounds in examples of ingenuity developed under the exigencies of the war. Alloy steels were one of the necessities of war production. Without these, industry could not carry on. At the beginning of 1941, deliveries of finished tool steel, because of enemy action, dropped to a level considered dangerously low. Meetings were held with the Machine Tool Control, and producers of tool steel, and as a result various modifications were made in the production schedules.

4.2 Japan's entry into the war deprived Britain of the main source of tungsten from Burma. Therefore, the first step taken was to devise steel that would use less tungsten than the 18 per cent usually required, and three types of high-speed steel were very soon evolved that effected the necessary economy. The work involved was considerable and had to be carried out under the spur of urgency. Apart from laboratory researches, the necessary fullscale steelworks tests were carried out. There was also the need of explaining to all users their characteristics and ensuring that the steelworks concerned were fully advised on the technique of production. All these requirements were fully met.

4.3 Research and production were not the only factors. Economy in the use and prevention of wastage also played important roles in helping the industry to meet its commitments. For example, the demand of tools tipped with high-speed steel was reduced. Collection and sorting of scraps were effectively organised. Control over industry ensured that tools were not used for non-essential purposes. Propaganda improved the care of tools by the operatives so that their working lives were increased. Various technical developments tended to the same end.

4.4 About half of the British Steel Industry's pre-war production depended on imported raw material and that half included the steels which were most vitally needed for war. The plants were not suited to an increased use of native ores, which were mostly low grade, and had only half the iron content of those obtained from overseas and also contained a high proportion of phosphorous. Apart from iron, coal and ferrosilicon, Britain depended on other countries for other raw materials needed by the steel industry. Most of the countries which supplied these, were largely over-run by the enemy or otherwise cut off. The switch-over to a greater use of native ore presented innumerable problems. The modifications in work practice, furnace design and specifications to make possible the use of high phosphoric ores, all presented difficulties, but these were solved. One example would serve to indicate what was achieved.

4.5 It was essential to reduce the use of hematite for making pig iron, which is mainly a base for making alloy steel. At the beginning of the war Britain was consuming 36,000 tons of hematite a week. By cutting down the use of high-class hematite altogether from the iron casting industry which formerly used one-third of the total, by substitution of other types of oxidisable ores, and by replacing the use of hematite by pig iron containing a high phosphoric content, very large savings were made. By 1942, weekly consumption of hematite was reduced from 36,000 tons to 22,000 tons, although the output of alloy steel was trebled in the same period.

4.6 One of the most important measures to cope with the raw material crisis was undoubtedly the utilization of every possible source of scrap in the U.K. Scrap helped to solve the Industry's problem from several points of view. Properly sorted—and sorting became a matter of highest importance—it provided a source of low phosphoric material. Moreover, from normal scrap about 95 per cent of its own weight of steel was obtained, so that the difficulties arising out of the use of low grade ore were mitigated.

4.7 The part played by scrap in war time British industry may be illustrated by a few more examples. Steel factories used 75 per cent of scrap, iron factories 50 per cent, wrought iron works 80 per cent, and refined pig iron 60 per cent. Including the quantities handled by the merchants but excluding works or "process", over 100,000 tons of collected scrap were melted every week by the iron and steel industry.

4.8 Cut off from four-fifths of its normal raw material supplies, the industry had to secure its output from inferior ores and in spite of shortages of critical constituents, constantly varying war needs had to be met.

It succeeded in supplying steel for 83,000 tanks, armoured cars and carriers, more than 1,000,000 unarmoured vehicles, 115,000 guns of calibre larger than 20 mm. and 150,000,000 rounds of ammunition for them. This it did by adopting the following steps :

(*i*) Strict control of raw material supply;
(*ii*) Increased use of indigenous low-grade ores;
(*iii*) Flexibility and adaptability to the war demands, and the minimum delay in execution.

5. Non-ferrous metals

5.1 Copper, zinc, lead, tin and nickel—the major non-ferrous metals other than aluminium — are vital sinews of war. No doubt, they are of fundamental importance to industry in peace-time also. The following figures compare the extent of the United Kingdom's pre-war and wartime consumption of the metals:

	Average pre-war 1936-38	Average war years 1940-43
Copper ...	270,000	456,000
Zinc. ...	200,000	249,000
Lead ...	345,000	223,000
Tin ...	22,000	27,000
Nickel ...	11,500	21,500

5.2 Against such large requirements, the United Kingdom's mine output of the metals was negligible, and practically the whole of the tonnage had to be imported.

The control problem was, therefore, to ensure sufficient supplies for war needs and essential civilian purposes, and at the same time, to reduce as far as possible the demands on shipping and on foreign exchange resources. The utmost economy in the use of metals was, therefore, of paramount importance and their use naturally came under statutory control. In order to confine the use of these metals to strictly essential purposes, non-essential applications had to be curtailed. Use of copper and lead pipes for plumbing and roofing purposes was virtually stopped. Use of zinc oxide was severely limited. Simultaneously, service requirements were also scrutinized. For example, in the manufacture of ammunition box linings, fuse covers, military equipment, fittings, etc. the use of non-ferrous metals was substantially cut down and replaced by metals like cast iron, steel, plastics and others.

5.3 Applicants for licences to obtain virgin and scrap metals had to furnish supporting schedule giving details of all the orders which they had to fulfil. For example for copper and copper alloys alone, the orders submitted amounted to 2,000 to 4,000 a day.

5.4 Metal was released only for orders approved by the control, and the control was guided by a staff of technical experts. A close co-operation between the manufacturers or Government departments concerned and the technical bodies such as the British Standards Institution was maintained. The contemplated use of substitute metals often involved increased difficulties in respect of labour, machining and wear and tear of tools and such considerations were given full weight before deciding whether to release or refuse non-ferrous metals for a particular purpose.

5.5 Apart from restricting the use of the metals, the control took action to foster the output of various vitally important non-ferrous metal products. It had to arrange for the organization and enlargement of productive capacity to meet the very high demand for brass strips and rods, copper tubes and zinc alloy die-castings for ammunition purposes. In particular, four steel mills were converted for the production of brass strips.

6. Silk, Rayon and Nylon

6.1 Silk, rayon and nylon have all played an important part in the war efforts. Before the out-break of the war, 80 to 90 per cent of the raw silk imported by the United Kingdom came from Japan, which produced about 80 per cent of the total world supplies. At that time, silk was the approved raw material for many essential uses, the most important being parachutes, insulation fabric and thread for the fine wire covering for electrical apparatus, cartridge bag fabric and for similar materials. The entry of Japan into the war, therefore, deprived the U.K. of the supply of silk. Steps were taken immediately to replace the silk supplies; but these measures could suffice to cover only a small proportion of the essential requirements and concurrently the development of substitute silk was vigorously persued. The most pressing need was for use in parachute production. Exacting standards had to be laid down involving long and detailed experiments and tests. A substitute finally approved was nylon.

6.2 The industry needed to produce nylon in large quantities, had to be developed from the laboratory bench to meet the defence requirements. The processing, weaving finishing and dyeing, all presented problems. Much of the technical use of synthetic fibre had been achieved during the war under stress of immediate necessity.

7. **Rubber and Synthetic Rubber**

7.1 The war had great effects on the rubber industry. Import of rubber had to be curtailed and the consumption was reduced. Very quick decisions were necessarily taken. Goods manufactured for export and for the civilian population were discontinued. For example, golf ball, tennis ball and rubber foot-wear manufacture, were all stopped. The manufacture of many articles previously made from rubber in various forms, were prohibited. Use of rubber latex for sponge rubber upholstery, mattresses, elastic thread and foot-wear was forbidden. Personnel in tanks and aircrafts had to dispense with foamed latex protective pads. The production of tyre was severely curtailed and as a result of this, in the early months of 1942 the rubber tyre industry lost some 25-30 per cent of its labour force.

7.2 From the critical days of early 1942, until the spring of 1944, when synthetic rubber began to enter largely into the production of rubber goods, the rubber industry tried to maintain production by making use of reclaimed rubber, and by restricting the volume of rubber used in such articles as tyres, conveyor belts, etc.

7.3 The use of synthetic rubber created a great upheaval. Its use in tyre accelerated the use of rayon, nylon and cotton in tyres. Percentage of synthetic rubber used by the British Industry rose to 70 per cent.

8. **Scientific Research**

8.1 There was no aspect of the war upon which scientific research had not been brought to bear with fruitful results. In the Navy, Army and Air Force, in respect of offence, defence and communications, in fields and factories even in the hospital, fundamental changes took place as a result of the systematic enlistment of the Nation's scientific workers in the service of the Nation. The inventiveness and ingenuity of the British scientists and engineers was at its peak. Indeed the Herculian task of mobilizing the country despite drastic cuts in imports, could not have been successful if the scientific man-power was not fullv geared to the nation's tasks.

8.2 The use of inferior grade iron ore, the development of good steel using less of tungsten, the production of nylon as a substitute for silk, and the synthetic rubber for the natural one, were all the fruits of scientific research.

8.3 The discovery of Sykes which led to great improvements in armourpiercing shells; Prof. Blackett and Bernal's Operational

Research—the application of statistical theory which vastly simplified and cheapened the inspection which plays so vital a part in modern workshop practice; the work of experimental psychologists on industrial fatigue; the discovery of Radar which proved an effective method in the location of bombers; jet propulsion which has revolutionized air travel and ushered in the era of space travel and missiles; the methods for locating submarines; the discovery of penicillin—all these and a host of other spectacular inventions and discoveries were made under the exigencies of war. Development of all these from an idea to large scale industrial utilization was an achievement requiring co-ordination between the scientists, the industrialists, the army, the Government and all the rest. The development of DDT can be given as an example of this co-ordinative effort.

8.4 The onset of the Far East hostilities revealed insecticides as a major munition of war. The United Kingdom lost the most important insecticides—pyrethrum and derris—just as the need for them immensely increased. While strenuous efforts were made to increase the production of pyrethrum flowers in Kenya, the synthetic material which came to be known as DDT was discovered almost simultaneously in the U.K. and the U.S.A. The programme of intensive research undertaken had no precedence. Companies, Government departments, chemical and pharmaceutical establishments, universities, hospitals and private soldiers in the army were organized in an intensive campaign to discover the potentialities of DDT, the best method of its use and the possible dangers to man while killing mosquitoes. Even before the final verdict could be given on the methods of safety and efficiency, the first Ministry of Supply plant was approved in 1943 to meet what was then expected to be the country's requirement of 100 tons a year. But as research progressed, this new material revolutionized ideas as to the extent to which an insecticide can reduce disease. In 1945 the production had already exceeded 5,000 tons a year.

9. Conclusion

9.1 The story of the great achievement of the British people during the war is of importance to us in India during this national emergency. We are dependent for our industrial development and maintenance on large scale imports. The disparity in the balance between the import and export and the need for defence preparedness has greatly depleted our foreign exchange resources. The market value of most of our exports which fall in the category of primary commodities, has been decreasing. On the other hand, the cost of manufactured goods which forms the bulk of our imports, has been continuously increasing. The challenge of the present crisis is, that despite all the difficulties, we have to press forward with our plan of economic development and defence preparedness at a more accelerated pace. This can be possible if following the example of the U.K., we cut down our imports to the barest minimum, restrict the use of the imported items only for the essential needs and utilize indigenous technical know-how and resources. In the task of industrial development, the public as well as the private sector has, so far, not utilized the scientific and technical capabilities of our National Laboratories. Tapping this potential source to the fullest possible extent is the need of the hour.

Shortage of Scientific Personnel

B. K. Nayar

The apparent scarcity of experienced personnel in the face of qualified unemployed scientific manpower has been causing anxiety. The U.P.S.C. reports every year a multitude of posts for which no suitable candidates could be secured through advertisement and interview, or personal contacts.

The generous pay scales, privileges and prestige of the Civil Service in India had played their role in attracting the best talent to the government, in the past. To-day these allurements seem less tangible, partly due to the general improvement in service conditions in the private sector and partly due to the vanishing aura of state service, with the rapid growth of the public sector. In many cases private industries and business offer higher scales of pay and better prospects to trained personnel. The U.P.S.C. seem to think it possible that quite a number of gifted people who can afford to take a little time over finding a career are not being attracted to the services. In the case of various specialised and technical posts, the government "has to compete with industrialists and businessmen and cannot often get even the second best of the meagre numbers available in the country".

In technologically advanced countries, the government is usually the largest individual employer of scientific manpower. The public sector in India employs about half of our scientists, engineers and technologists. The recruitment and management of this large body of scientists and technologists poses major problems that have hardly been faced even in the biggest privately owned industrial organisations. Science advances so rapidly that the traditional methods of management are not necessarily suited, nor sufficiently adaptable to meet modern needs. New methods have, therefore, to be devised.

At present considerable numbers of talented technical graduates and research scholars are joining the administrative services. On an average, 50 outstanding post-graduates in science join the I.A.S. and allied services every year. Numerous candidates belonging to the technical services or holding technical posts, apply for administrative positions. The drift of recognised scientists from their work-benches to the office desk continues unabated. Obviously it is not in public interest that technical and scientific personnel who are badly needed in their own lines should feel tempted to go into administrative line. A properly attractive scientific career should be provided to our science graduates, particularly for those who show promise for research or innovation, otherwise the scientific and technical personnel required for implementing the various developmental projects will continue to be inadequate.

It has been realised that ready-made personnel with not only the theoretical and academic qualifications, but also the necessary type and quality of experience, is not always available. Possibly some of the deficiencies noticed among the candidates, on the technical side, may well be made up, if well-planned courses of training are prescribed for the successful candidates during probationary period for all important appointments. One remedy, in the considered opinion of the U.P.S.C. is to "organise the large number of isolated posts of this kind into regular services and/or cadres. Recruitment should thereafter be made to the juniormost post on competitive basis and full facilities for up-to-date training of such candidates should be provided. This is how personnel for the superior and key-posts in the technical and specialised fields can be built up."

One of the measures successfully adopted in several countries to tide over such emergencies is the contract type of employment. This technique makes possible the hiring of specialists at a higher pay than that offered in the standard pay plan. As contract employees do not receive the normal civil service benefits and protection, the granting of higher pay under contract is not incompatible with an established civil service pay system. This technique also permits the organisation to have greater flexibility in eliminating employees who are not meeting performance requirements. Another result of the use of contracts is to stimulate more interchange with industry and education, by eliminating the permanence aspect of government employment. This expedient also helps improve standards of performance. As Sir G.P. Thomson the British Nobel Laureate said "Government science would be much more fruitful if no man were allowed to stay for more than ten or twelve years in one establishment. He would lose some little time learning new jobs, but would bring a fresh outlook to them, which would be more than compensation."

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off in its level of advancement, some of the industrial firms may be in a position to pick up processes at an early stage and be able to productionise on their own. But by far and large, for historical reasons, most industrial firms are in the stage of slow transformation from traders and financiers to manufacturers and industrialists. Industrial manufacture is by its very nature conservative as compared to research. Scientists and technologists will be helping expedite a smooth change-over if they wisely choose to be thorough with a limited number of processes and projects than attempt cheap publicity by grandiose claims to a large number of patents and inventions of doubtful practical applicability.

Finances of 51 Industrial Giants in India 1964-65

The gross profits of 51 Giant Companies in the private sector amounted to Rs. 153.7 crores in 1964-65 , compared with Rs. 132.9 crores in the previous year, recording a rise of 15.7 per cent. Pre-tax profits and profits after tax also recorded sizeable increases.

During 1964-65, the rate of increase in profits was slightly higher than the rate of increase in the total capital employed and sales and, consequently, the profitability rates recorded a moderate improvement over the previous year's level. Gross profits of the 51 Giants expressed as a percentage of total capital employed (total assets) moved up from 10.8 per cent to 11.6 per cent, while net profits as a percentage of net worth rose from 9.6 per cent to 10.6 per cent.

The Tata Iron and Steel ranks first in size, with a wide margin among the 51 Industrial Giants, the accounts of which have been analysed and presented in this study of "The Economic Times" . The survey, which lists the very big non-Government public limited companies on the basis of their total assets, ranks Indian Iron (Rs. 102.6 crores) second well behind TISCO (Rs. 161.0 crores). The steel companies at the top of the list are followed by Telco, Associated Cement, Scindia Steam and Burmah-Shell Refineries in that order.

This study relates to the year 1964-65; data presented in the study against this year relate to the accounting periods of the various companies ended during the 12 months—July, 1964-June, 1965. An overwhelming majority of the companies included here closed their accounts as at the end of either December, 1964 or March, 1965.

The list of 51 Giant companies together with the important data relating to their assets, net worth, sales, profits etc., are shown on the *flysheet*. The graph appearing on page 15 depicts the relative size of the companies in terms of their total assets.

In this study, Government companies, private limited companies, banks, insurance companies and other financial institutions are not included.

Size of Companies : The total paid-up capital of these 51 companies amounted to Rs. 316.2 crores and measured by this criterion, they account for approximately one-third of the entire non-Government non-financial public limited corporate sector in India. In terms of total net assets also, these companies account for nearly the same proportion. They are called Giant Companies only because they together constitute about one-third of the sector covered, while the remaining two-thirds are accounted for by about 6,400 companies.

International Comparison : The term 'Giant Companies' was first introduced by the Company Law Administration to connote the giants of the Indian industrial scene. They should not be regarded as giants in absolute terms, particularly on account of the smallness of their size on international comparison. For instance, Tisco's total assets are only as big as 3.01 per cent, that of the General Motors of U.S.A., the largest corporation in that country, and 3.01 per cent of Royal

Dutch Shell (Netherlands-Britain), the largest non-American corporation in the world. In terms of sales, Tisco is still smaller—only 1.51 per cent of the General Motors; compared with that of Royal Dutch/Shell, Tisco's turnover is 3.76 per cent.

If the top 51 Industrial Giants of India are compared with the top 51 of the U.S.A., the average U.S. giant would be found to be 42 times as large as its counterpart in India. The U.S. average giant company's sale is 53 times as large as that of the Indian giant company.

It may be recalled in the context that Tisco, which ranked 179th in the *Fortune's* rating of 200 largest non-American industrial companies in 1963, was ranked lower at 186th in 1964 and unfortunately, did not find a place in their 1965 ranking (*vide Fortune*, August 1965). Thus, the biggest giant of the Indian industrial scene, in the private sector, has lost even its low place which it held a year back.

Average size : The average size of the total assets of the 51 Giant companies was Rs. 26.0 crores. The sales income of these companies averaged at Rs. 23.9 crores per company during 1964-65.

The above data depict a somewhat exaggerated picture of the concentration of ownership and control of the corporate units in India; the figures should be read in the context of the broadening share ownership in recent years (Tisco alone having 74,948 shareholders) and the continuously increasing controls exercised by Government on the management of the units, their expansion programmes, pricing policies and licensing of imports of machinery, essential components and raw materials.

Total Assets : The total assets of the 51 Giant companies rose from Rs. 1,229.1 crores to Rs. 1,326.2 crores, i.e., by 7.9 per cent. Tisco's assets account for 12.1 per cent of the total assets of the 51 Giants, while the two iron and steel companies together account for nearly one-fifth.

The following five companies showed the largest growth rates in total assets during 1964-65, over the previous year :

	% increase
Jayanti Shipping	42.5
Larsen & Toubro	35.7
Hindustan Aluminium	34.9
Union Carbide	28.7
Texmaco	28.6

In all the five cases, the growth rate was substantially high.

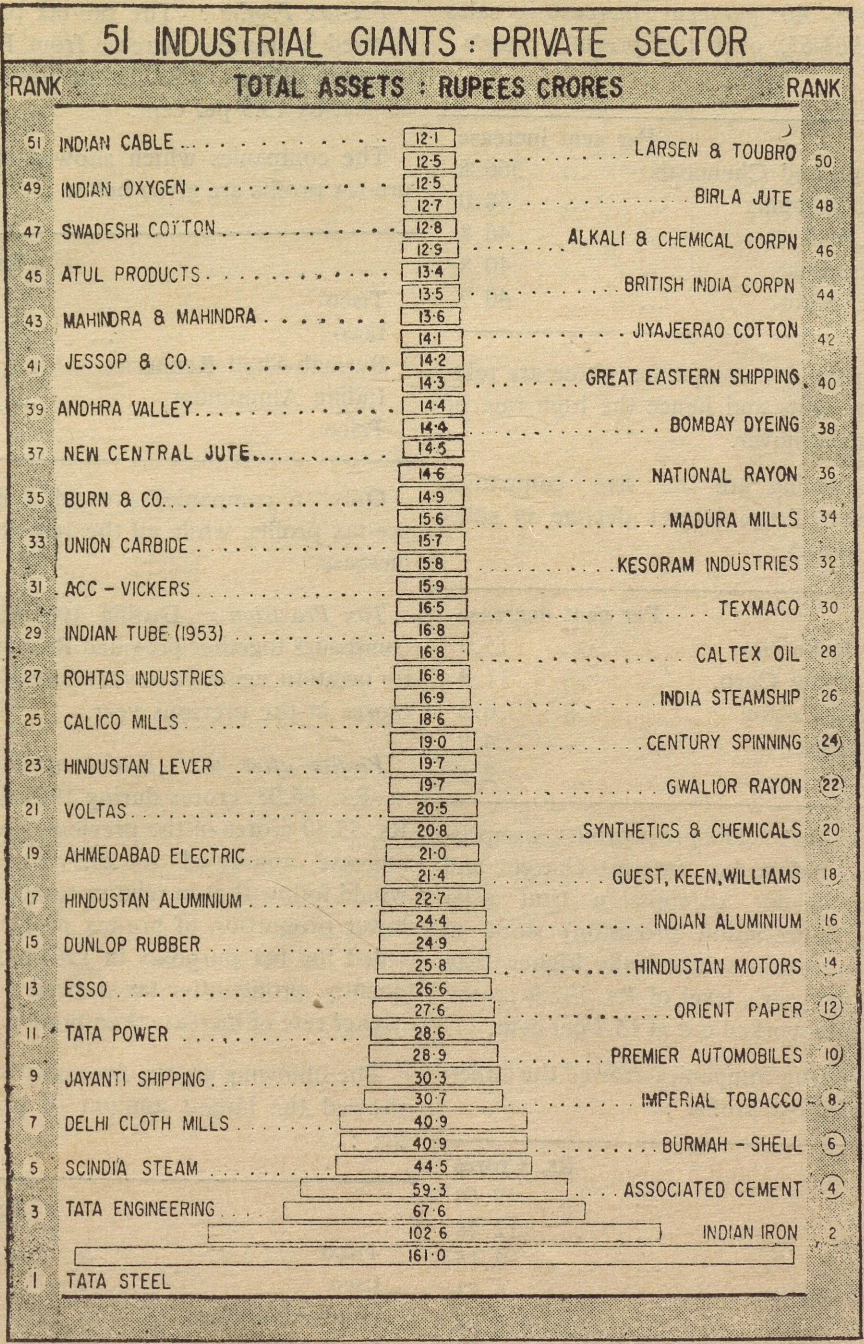
The following five companies showed the largest rate of decline in total assets :

	% decrease
National Rayon	4.7
India Steamship	4.4
Burn & Co.	4.4
Caltex Refineries	3.9
Great Eastern Shipping	3.2

Net Worth : The net worth (comprising paid-up capital and, reserves and surplus) at the end of 1964-65 amounted to Rs. 631.7 crores, compared with Rs. 579.2 crores at the end of the previous year. This showed an annual rate of growth of 9.0 per cent. Tisco's net worth is obviously the highest. Indian Iron stood second, followed by A. C. C., Burmah-Shell Refineries and Imperial Tobacco in that order.

The five companies, which showed the highest rate of increase in net worth, are shown below :

	per cent increase
Hind Aluminium	72.9
A.C.C.-Vickers	42.3
Dunlop Rubber	34.0
Larsen & Toubro	32.9
Burmah-Shell Refineries ...	32.3



Sales : The total sales of the 51 Giant companies amounted to Rs. 1216.5 crores during 1964-65, compared with Rs. 1091.0 crores in the previous year, recording an annual rate of growth of 11.5 per cent.

The following five companies have shown

more than 40 per cent increase in sales during 1964-65, over the previous year's level :

	Per cent increase
Synthetic and Chemicals ...	366.5
Jayanti Shipping	58.0
A.C.C.-Vickers	46.8
Atul Products	40.8
Premier Auto	40.7

Among the five companies, three are relatively new units and hence the high rate of increase in turnover.

The following are the five companies which showed the largest decline in sales during 1964-65 :

	Per cent decrease
Caltex Refineries	15.3
British India Corp.	11.9
Swadeshi Cotton	6.3
Burmah-Shell	4.9
Rohtas	2.5

Gross Profits : The gross profits, comprising profits before tax, interest charges and managing agency commission (but after deducting depreciation provision) stood at Rs. 153.7 crores—substantially higher than the previous year's level of Rs. 132.9 crores. This increase worked out at 15.7 per cent.

The following companies showed the largest amount of gross profits :

	Rs. Crores
Tisco	19.64
Iisco	12.48
Telco	7.15
Burmah-Shell	6.73
A.C.C.	5.84

Among the 51 companies, 37 companies showed an increase in profits, while 14 companies showed a decline.

Pre-tax Profits : The pre-tax profits also showed a sizeable increase from Rs. 110.59 crores in 1963-64 to Rs. 125.91 crores in 1964-65 i.e. by 13.9 per cent.

The companies which showed the largest pre-tax profits are given below :

	Rs. crores
Tisco	15.69
Iisco	10.82
Burmah-Shell Refineries ...	6.31
Indian Aluminium	5.05
Telco	4.96

Only 16 companies showed a decline in pre-tax profits, while all the rest showed an increase.

Tax Provision : During 1964-65, the 51 companies together provided Rs. 58.93 crores for taxation, against a lower figure of Rs. 55.21 crores in the previous year.

Profits after tax : Profits after tax stood at Rs. 66.98 crores during 1964-65, against Rs. 55.40 crores in the previous year. This increase amoun ed to 20.9 per cent. It would follow that in relative terms, a slightly lower proportion of pre-tax profits was provided for tax purposes in 1964-65. Consequently, profits after tax showed a markedly higher rate of increase than pre-tax profits.

The following are the five companies which showed the largest amount of profits after tax :

	Rs. Crores
Tisco	6.54
Iisco	6.28
Hind Aluminium	3.49
Hind Motors	2.96
Telco	2.88

It will be seen from the Table on *flysheet*

THE FINANCES OF 51 PUBLIC LIMITED GIANT COMPANIES IN THE PRIVATE SECTOR : 1964—65

Rank (a)		Name of Company	End of latest Accounting year	Total assets (b)			Net worth (c)			Sales (d)			Gross Profits (e)		Profits before tax		Tax Provosional (k)		Profit after tax (f)		Distributed profits		Retained profits (g)	
1963-64	1964-65			1963-64	1964-65	Percentage increase(J)	1963-64	1964-65	Percentage increase (J)	1963-64	1964-65	Percentage increase(j)	1963-64	1964-65	1963-64	1964-65	1963-64	1964-65	1963.64	1964-65	1963-64	1964-65	1963-64	1964-65
1	2	3	4	5	6	7	8	9	10	11	14	13	14	15	16	17	18	19	20	21	22	23	24	25
1·	1·	Tata and Iron Steel (h)	31-3-65	159·2	161·0	1·2	81·1	84·6	4·4	110·4	122·1	10·6	17·56	19·64	15·20	15·69	7·45	9·15	7·75	6·54	5·25	5·25	2·50	1·28
2·	2·	Indian Iron and Steel (i)	31-3-65	99·9	102·6	2·7	54·7	59·0	8·0	76·0	78·7	3·5	12·09	12·48	10·32	10·82	3·87	4·54	6·45	6·28	2·29	2·29	4·16	3·99
3·	3·	Tata Engg. & Locomotive	31-3-65	56·8	67·6	19·0	17·3	19·3	11·3	51·5	66·1	28·4	5·14	7·16	3·73	4·96	2·00	2·08	1·73	3·88	1·44	1·57	0·80	1·41
4·	4·	Associated Cement	31-7-64	55·8	59·3	6·2	27·7	29·6	6·6	47·2	50·4	6·7	6·26	5·84	5·34	4·71	2·68	2·59	2·66	2·12	2·29	2·29	0·37	—0·17
5·	5·	Scindia Steam	30-6-65	43·3	44·5	2·8	2·8	23·4	—1·3	17·1	18·2	6·3	1·76	1·79	1·34	1·29	0·33	0·37	1·02	0·92	0·70	0·70	0·32	0·22
7·	6·	Burmah-Shell	31-12-64	36·4	40·9	12·2	22·2	29·3	32·3	14·0	13·4	—4·9	7·18	6·73	6·76	6·31	4·44	3·45	2·32	2·86	4·00	2·91	—1·68	—0·05
6·	7·	Delhi Cloth Mills	30·6·65	36·9	40·9	10·7	13·7	14·0	2·2	46·8	52·8	12·8	2·58	2·47	1·51	0·28	0·28	0·17	1·24	1·00	0·83	0·85	0·41	0·15
8·	8·	Imperial Tobacco	31-3-65	29·2	30·7	5·1	25·9	26·1	0·7	55·4	59·4	7·1	2·89	4·34	2·88	4·32	1·87	2·67	1·01	1·65	0·99	1·36	0·02	0·29
15··	9	Jayanti Shipping	31-3-65	21·2	30·3	42·5	2·3	2·7	19·2	4·9	7·8	58·0	—0·10	0·71	—0·18	0·51	—	—	—0·18	0·51	—6·09	—	—0·18	0·51
9·	10·	Premier Automobiles	30-6-65	26·8	28·9	8·1	9·4	10·2	7·6	24·1	33·9	40·7	1·56	2·24	0·80	1·22	0·34	—	0·46	1·22	0·29	0·37	0·17	0·84
11·	11·	Tata Power	31-3-65	26·1	28·6	9·4	10·6	11·3	6·7	8·0	8·8	9·2	2·94	3·11	2·20	2·28	0·91	0·93	1·29	1·36	0·43	0·68	0·86	0·67
12·	12·	Orient Paper	31-3-65	22·5	27·6	22·8	8·8	9·6	9·1	11·3	11·2	—1·4	1·68	1·24	1·22	0·27	0·47	—	0·75	0·27	0·51	0·51	0·24	—0·24
10·	13·	Esso	31-12-64	26·4	26·6	0·8	16·1	17·2	6·9	43·5	42·2	—0 8	4 02	3·34	3·72	2·06	2·43	1·87	1·29	1·19	0·50	0·05	1·25	1·15
17·	14·	Hindustan Motors	31-3-65	20·8	25·8	23·8	11·1	13·0	17·2	32·6	41·1	26·1	3·07	4·47	2·85	3·91	1·43	0·95	1·42	2·96	0·94	1·02	0·49	1·94
13·	15·	Dunlop Rubber	31-12-64	21·9	24·9	13·9	11·4	15·3	34·0	40·7	45·3	11·3	3·58	4·38	3·28	3·98	1·59	1·95	1·69	2·03	0·83	1·14	0·86	0·89
14·	16·	Indian Aluminium	31-12-64	21·8	24·4	11·9	11·5	13·9	20·9	13·9	14·8	6·9	4·35	5·41	3·86	5·05	1·99	2·57	1·86	2·48	0·98	1·16	0·88	1·32
15·	17·	Hindustan Aluminium (m)	31-12-64	16·8	22·7	34·9	6·6	11·4	72·9	8·0	11·1	39·5	0·68	3·93	0·06	3·49	—	—	0·06	3·49	0·22	0·22	—0·17	3·26
16·	18·	Guest, Keen, Williams	30-12-64	20·9	21·4	2·5	11·8	12·5	5·5	22·5	26·9	19·4	3·13	3·63	2·71	3·38	1·35	1·65	1·36	1·73	0·70	0·82	0·66	0·90
19·	19·	Ahmedabad Electric	31-3-65	20·4	21·0	3·3	11·1	11·7	5·5	8·3	10·0	20·4	1·78	2·60	1·36	0·44	0·44	0·93	0·92	1·13	0·70	0·70	0·22	0·43
18·	20·	Synthetics & Chemicals	31-12-64	20·6	20·8	1·3	5·6	5·8	2·8	0·9	4·4	366·5	0·35	1·05	—0·19	0·18	—	—	—0·29	0·18	—	—	—0·29	0·18
20·	21·	Voltas Ltd.,	31-8-64	20·1	20·5	1·7	5·0	5·:	7·9	32·4	37·3	15·1	2·07	2·43	1·71	2·04	1·16	1·42	0·55	0·62	0·62	0·36	0·38	0·24
22·	22·	Gwalior Rayon	31-3-65	19·0	19·7	4·0	9·3	9·9	7·2	16·2	22·3	37·6	2·70	3·42	2·53	3·11	1·25	1·48	1·29	1·62	0·82	0·88	0·47	0·74
21·	23·	Hindustan Lever	31-12-64	29·9	19·7	—1·1	12·0	12·7	5·4	59·5	51·9	3·9	4·47	3·92	4·45	3·84	2·83	2·09	1·62	1·74	1·15	0·46	0·59	0·59
25·	24·	Century Spinning	31-12-64	17·2	19·0	10·5	8·7	10·0	14·5	22·3	25·5	14·6	2·85	3·41	2·38	2·91	0·81	1·37	1·57	1·54	0·87	1·01	0·70	0·53
28·	25·	Calico Mills	31-3-65	16·2	18·6	14·8	5·1	6·0	17·0	15·7	17·2	9·0	1·30	3·16	0·63	2·34	0·18	0·78	0·44	1·56	0·63	0·66	—0·19	0·89
23·	26·	India Steamship	31-3-65	17·7	16·9	—4·4	4·4	4·6	4·2	8·3	8·3	0·3	0·42	0·52	0·90	0·33	—	—	0·09	0·32	0·02	0·14	0·07	0·18
27·	27·	Rohtas Industries	31-3-65	16·3	16·8	3·3	8·7	8·7	—0·3	18·9	18·4	—2·5	1·05	1·00	0·70	0·66	0·34	0·22	0·37	0·44	0·47	0·37	—0·10	0·08
24·	28·	Caltex Oil	31-12-64	17·4	16·8	—3·9	10·7	10·2	—5·1	2·6	2·2	—15·3	0·63	0·31	0·52	0·20	0·41	0·26	0·11	—0·06	0·42	—	0·31	—0·06
31·	29·	Indian Tube (1953)	31-12-64	15·4	16·8	8·7	8·3	8·6	2·8	19·2	20·7	7·9	2·74	3·05	2·62	2·87	1·60	1·81	1·02	1·06	0·93	1·00	0·09	0·07
40·	30·	Texmaco	31-12-64	12·8	16·5	28·6	4·2	4·8	14·5	12·2	12·0	—2·1	2·39	2·42	2·07	2·05	1·24	1·20	1·20	0·83	0·34	0·38	0·49	0·47
29·	31·	ACC—Vickers	31-3-65	16·0	15·9	—0·7	3·7	5·3	42·3	5·5	8·0	46·8	—0·13	0·40	—0·15	0·31	—	—	—0·15	0·31	—	—	—0·15	0·31
32·	32·	Kesoram Industries	31-3-65	15·4	15·8	2·3	7·8	8·2	5·4	15·8	16·3	3·6	1·88	1·59	1·47	1·13	0·53	0·35	0·94	0·78	0·40	0·40	0·54	0·38
42·	33·	Union Carbide	25-12-64	12·2	15·7	28·7	6·6	8·7	31·1	14·3	16·0	11·3	2·81	3·15	2·73	3·07	1·70	1·73	1·03	1·34	0·42	0·55	0·61	0·80
36·	34·	Madura Mills	31-12-64	13·6	15·6	14·6	7·9	8·1	3·3	18·2	19·6	7·6	1·81	1·69	1·48	1·22	0·58	0·67	0·83	0·55	0·31	0·31	0·53	0·25
30·	35·	Burn & Co.	30-4-65	15·6	14·9	—4·4	4·3	4·5	4·6	13·3	14·3	7·6	1·75	1·66	1·66	1·52	0·61	0·99	1·05	0·54	0·28	0·32	0·77	0·22
33·	36·	National Rayon	31-12-64	15·3	14·6	—4·7	6·6	6·9	7·3	11·6	14·2	21·8	1·77	2·08	1·25	1·60	0·66	0·84	0·59	0·76	0·48	0·58	0·11	0·18
17·	37·	New Central Jute (l)	31-3-63	11·9	14·5	22·3	5·3	6·2	16·8	15·1	12·9	—14·9	0·09	1·69	—0·19	1·33	—	—	—0·19	1·33	0·03	0·41	—0·22	0·92
35·	38·	Bombay Dyeing	31-12-64	14·4	14·4	—	6·3	6·7	7·1	16·9	19·6	16·2	1·03	1·25	0·60	0·78	0·28	0·30	0·32	0·49	0·35	—0·40	—0·30	0·09
37·	39·	Andhra Valley	31-3-65	13·5	14·4	6·9	5·2	5·5	5·3	4·5	5·0	10·3	1·39	1·51	1·00	1·08	0·32	0·40	0·68	0·68	0·34	0·40	0·34	0·28
34·	40·	Great Eastern Shipping	30-6-65	14·8	14·3	—3·2	4·1	4·3	3·8	5·3	5·3	0·4	0·75	0·65	0·42	0·30	0·01	0·01	0·41	0·29	0·12	0·17	0·29	0·13
43·	41·	Jessop & Co.	31-10-64	12·2	14·2	16·8	5·2	5·8	10·4	14·7	16·7	13·6	1·69	2·08	1·56	1·88	0·85	1·08	0·71	0·80	0·22	0·27	0·49	0·53
39·	42·	Jiyajeerao Cotton	31-3-65	13·2	14·1	7·1	10·1	10·7	5·9	12·9	14·2	10·0	2·15	2·35	2·00	2·19	0·73	1·10	1·27	1·09	0·55	0·55	0·72	0·54
38·	43·	Mahindra & Mahindra	31-10-64	13·4	14·6	1·6	3·5	3·8	9·3	15·9	20·7	29·7	1·33	2·12	0·99	1·70	0·58	1·02	0·41	0·68	0·27	0·34	0·15	0·33
41·	44·	British India Corpn.	31-12-64	12·6	13·5	7·0	6·7	6·9	3·9	12·9	11·3	—11·9	2·45	1·39	2·22	1·12	1·33	0·53	0·89	0·59	0·57	0·38	0·32	0·22
46·	45·	Atul Products	31-12-64	11·9	13·4	12·1	5·1	5·2	2·0	4·3	6·0	40·8	0·96	1·06	0·60	0·63	0·23	0·15	0·37	0·47	0·37	0·39	—	0·08
48·	46·	Alkali & Chemical Corpn.	30-9-64	11·8	12·9	8·8	5·7	6·2	8·5	8·3	8·8	6·6	1·32	1·38	1·12	1·11	0·34	0·12	0·78	0·99	0·49	0·64	0·29	0·35
49·	47·	Swadeshi Cotton	31-12-64	11·8	12·8	8·3	5·0	5·0	0·3	15·0	14·0	—6·3	0·63	0·98	0·21	0·53	0·13	0·30	0·09	0·23	0·12	0·12	—0·03	0·11
44·	48·	Birla Jute	31-3-65	12·2	12·7	3·7	7·2	7·3	1·6	21·3	13·3	8·4	1·39	1·29	1·11	0·94	0·94	0·48	0·75	0·46	0·33	0·33	0·41	0·13
45·	49·	Indian Oxygen	30-9-64	11·9	12·5	4·9	5·3	5·6	5·6	10·2	12·1	18·6	1·57	1·79	1·40	1·59	1·75	0·86	0·65	0·73	0·44	0·44	0·21	0·29
51·	50·	Larsen & Toubro	31-3-65	9·2	12·5	35·7	2·9	3·9	32·9	8·6	9·7	13·2	1·17	1·29	0·90	0·94	0·50	0·52	0·40	0·43	0·26	0·29	0·15	0·14
50·	51·	Indian Cable	31-3-65	10·5	12·1	15·5	6·0	6·4	6·0	12·0	14·1	18·0	1·98	2·05	1·09	1·93	1·03	0·98	0·87	0·95	0·62	0·62	0·24	0·33
		Total for 51 companies		**12,29·1**	**13,26·2**	**7·9**	**579·2**	**631·7**	**9·0**	**10,91·0**	**12,16·5**	**11·5**	**1,32·91**	**1,53·74**	**1,10·59**	**1,25·91**	**55·21**	**58·93**	**55·40**	**66·98**	**36·42**	**37·77**	**19·00**	**29·21**

(*a*) Ranked by total assets. (*b*) Net fixed assets, inventory and all other tangible and intangible assets excluding advance payment of tax; (*c*) Paid up capital alnd all reserves including taxation and fedeferred taxation reserve, accumulated balance of debenture redemption reserve, sinking funds and surplus loss carried forward; (*d*) Relate to main income and in the case of non-manufacturing units include services rendered and contracts invoiced by engineering companets; exclude income ifrom investment and other miscelaneous income; (*e*) Profits before tax plus managing agents' remuneration and interest charges but excludes depreciation; (*f*) Distributed profits plus retained profits ; (*g*) All transfers from the accounts of earlier years are adjusted back so that profits figure shown here relates exclusively to the operations of the year concerned; (*h*) Sales are net of rebate payable to Government and adjusted for increase in retention prices, profits are arrived at after readjusting retention price and not pertaining to the year concerned; (*i*) Sales including departmental orders and items used in works; profits and sales are arrived after readjusting the retention prices pertaining to the previous years; (*j*) Percentages are worked out before the figures are rounded off; (*k*) includes surtax and dividend tax provided by the companies; (*m*) Preference dividend shown against this company is payable. (*l*) Figures relate to 1961-62 and 1962-63. "—" indicates nil.

A few figures published in respect of 1963-64 have now been revised on the basis of additional information which has become available subsequent to the publiation of our similar study for 1963-64.

that 49 out of the 51 companies showed an increase in profits after tax.

Distributed Profits : The total dividend payments, including those on preference shares, worked out at Rs. 37.77 crores during 1964-65, against Rs. 36.42 crores in the previous year. Despite a large increase in capital employed, sales and profits, dividends showed only a small increase of 3.7 per cent.

Retained Profits : There was a spurt in retained profits from Rs. 19.0 crores to Rs. 29.1 crores. Thus, the major increase in net profits was ploughed back into business.

Profit Appropriation : The appropriation of pre-tax profits during the two years is given below :

		Percentages	
		1963-64	1964-65
Tax provision	...	49.9	46.8
Distributed profits	...	32.9	30.0
Retained profits	...	17.2	23.2

Both tax provision and distributed profits accounted for a lower proportion of pre-tax profits in 1964-65 and consequently, the share of retained profits went up substantially.

Profit Ratios : The following are the usual ratios for 51 Giant companies :

		Percentages	
		1963-64	1964-65
Gross profits as % of sales	...	12.2	12.6
Gross profits as % of total capital employed	...	10.8	11.6
Profits after tax as % of net worth	...	9.6	10.6

All the profitability rates recorded a moderate increase.

Big Five from various Angles : The graph appearing on *flysheet* shows the top rankers among the 51 Giants considered from various angles. Tata Steel gets the pride of place based on all the four criteria considered in the graph. Indian Iron stood uniformly second. Telco secured the third place according to total assets and sales, and the fifth place according to profits before tax. A.C.C. gets the fourth rank in assets and third in net worth, Burmah-Shell Refineries ranked fourth in terms of net worth, while it secured the third place when ranked according to profits before tax. The other companies which figure among the first five according to different criteria are Imperial Tobacco, Hindustan Lever and Indian Aluminium.

Displaced from 51 : From last years' ranking of 51 Industrial Giants, five companies get displaced this year—Tata Chemicals, Titaghur Paper, Ballarpur Paper, Ashok Leyland and Tata Hydro.

New Entrants : The five new entrants to the list of 51 Giants are Jayanti Shipping, Hindustan Aluminium, Synthetics and Chemicals, A.C.C.-Vickers, and Larsen and Toubro.

Moved Up : Columns 1 and 2 of the Table on *flysheet* show the ranking of the 51 Giants according to total net assets during 1963-64 and 1964-65, respectively. An examination of the ranks shown in these two columns reveals that among the first ten, Burmah-Shell moved up from 7th to 6th place and Jayanti Shipping from 15th to 9th place. Delhi Cloth moved down from 6th to 7th place, and Premier Auto from 9th to 10th place.

Industrial Grouping : The following is the grouping of the 51 Industrial Giants according to various industries to which they belong :

	No. of Companies
Engineering	... 12
Cotton Textiles	... 7
Chemicals	... 4
Electricity	... 3
Shipping	... 4
Petroleum	... 3
Paper	... 1
Iron & Steel	... 2
Jute Textiles	... 2
Aluminium	... 2
Rayon Textiles	... 2
Cement	... 1
Others	... 8
Total	... 51

Of the total assets of the 51 Giant companies, the two iron and steel companies accounted for 19.9 per cent, the 12 engineering companies for 19.6 per cent and the three petroleum companies for 6.4 per cent.

Industrial Profits : As the 51 Industrial Giants account for about one-third of the public limited sector (non-financial non-Government) the combined results obtained from this study can be assumed to portray quite faithfully the trends in industrial profits during 1964-65. Thus, assuming the pattern of finances revealed by this study of the 51 Giant companies, it is safe to conclude that, with an increase in net worth and assets employed in business, sales and profits also moved up substantially during 1964-65, compared with the previous year. There was also a small improvement in the profitability rates.

Another Ranking : When Government companies and private limited companies are brought into the scene, the entire picture changes. The list which accompanies shows the ranking of the 51 Industrial Giants in the entire corporate sector—i.e., including Government companies and private limited companies in the private sector. In respect of some Government companies, figures for the year ended 1964-65 are not available, and hence previous year's figures are used. On account of this limitation, some slight shifts in the ranks are possible. But it can be known only when all the Government companies publish their accounts for the year 1964-65. In this ranking, obviously Hindustan Steel tops the list followed by Tata Steel, Indian Oil Corpn., Neyveli Lignite and Heavy Engineering Corporation in that order. Only a single company in the private sector, viz., Tisco, secures a place among the top five, and its assets account for 11.9 per cent of the total of the first five and 5.5 per cent of the total of the 51 companies in the following list :

51 Top Companies : Government and Private Sector

(Rs. crores)
(Total assets)

Name of the company	1964-65
1. Hindustan Steel (G) ...	826.6*
2. Tata Iron & Steel ...	161.0
3. Indian Oil Corporation (G) ...	137.3
4. Nevyeli Lignite (G) ...	118.2*
5. Heavy Engineering Corporaration (G) ...	105.7*
6. National Coal Development Corporation (G) ...	103.2*
7. Indian Iron & Steel ...	102.6
8. Fertiliser Corporation of India (G) ...	99.6*
9. Heavy Electricals (G) ...	77.7
10. Telco ...	67.6
11. Associated Cement ...	59.3
12. Oil India ...	58.7
13. Air India (G) ...	54.6
14. Hindustan Aircraft (G) ...	48.9*
15. Shipping Corporation of India (G) ...	44.6
16. Scindia ...	44.5
17. Burmah-Shell Refineries ...	40.9
18. Delhi Cloth Mills ...	40.9

Name of the company	1964-65	Name of the company	1964-65
19. Indian Airlines (G) ...	35.1*	38. Hindustan Lever ...	19.7
20. Imperial Tobacco ...	30.7	39. State Trading Corporation (G) ...	19.2
21. Jayanti Shipping ...	30.3	40. Century ...	19.0
22. Hindustan Machine Tools (G) ...	29.9*	41. Calico ...	18.6
23. Premier Auto ...	28.9	42. India Steamship ...	16.9
24. Tata Power ...	28.6	43. Rohtas ...	16.8
25. Orient Paper ...	27.6	44. Caltex ...	16.8
26. Esso ...	26.6	45. Indian Tube (1953) ...	16.8
27. Hindstan Motors ...	25.8	46. Texmaco ...	16.5
28. Dunlop Rubber ...	24.9	47. ACC-Vickers ...	15.9
29. Indian Aluminium ...	24.4	48. Kesoram Industries ...	15.8
30. Hindustan Aluminium ...	22.7	49. Union Carbide ...	15.7
31. FACT (G) ...	21.9	50. Madura Mills ...	15.6
32. Singereni Collieries (G) ...	21.9	51. Burn & Co. ...	14.9
33. Guest, Keen, Williams ...	21.4		
34. Ahmedabad Electric ...	21.0	Total ...	29,12.8
35. Synthetics and Chemicals ...	20.8		
36. Voltas ...	20.5		
37. Gwalior Rayon ...	19.7		

(G) Government Companies.
*Relating to 1963-64.

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ASWI Activities

The second Meeting of the Preparatory Committee for CAAUST Symposium was held on January 16 and 17, 1966 in New Delhi. It may be recalled that after attending the Symposium on 'Science and the Nation' during the Third Five Year Plan held in New Delhi during July 27-30, 1964 and after visiting the various scientific institutions in India, the visiting scientists from Afro-Asian Countries met on 11th August, 1964 and decided that an international Symposium on 'Scientific Collaboration between the countries of Asia and Africa' be held in India sometimes by the end of 1965.

A Preparatory Committee consisting of 10 members with Dr. S. Husain Zaheer as Convener, was constituted. The first meeting of the Preparatory Committee was held in Cairo on April 24-25, 1965. The second meeting, held in New Delhi, was attended by five members representing India, U.S.S.R., Ceylon, Lebanon and U.A.R.

Dr. N. P. Gupta, President of the Association of Scientific Workers of India, welcomed the delegates on behalf of A.S.W.I. The meeting elected Dr. S. Husain Zaheer as the Chairman.

The Preparatory Committee recorded its deep sense of sorrow on the passing away of Shri Lal Bahadur Shastri, the Prime Minister of India. All members stood in silence in respectful memory of Shastriji.

The following were the important decisions taken at the meeting.

(*i*) The Sympoisum be held from 25th April to 2nd May 1966 and not in the month of February as originally suggested.

(*ii*) Agencies like Unesco, World Federation of Scientific Workers, Organization of African Unity and League of Arab States be immediately approached for assistance to the organization of the Symposium.

(*iii*) In order to obtain greater support for the Symposium individual scientists, societies and governments of different countries be approached. The host Organising Committee should, on behalf of Organising Committee, extend invitation through the Indian Foreign Ministry and the Embassies of the Government of India, to countries of Asia and Africa.

(*iv*) All papers in a particular session of the Symposium should be taken as read. The key paper will be prepared covering all the papers submitted for a particular section by an Indian participant. The authors of the papers would also be asked to highlight or emphasise particular points of their papers. Greater amount of time should be devoted to discussion of the topic and not on reading of papers.

(*v*) The rules for the conduct of the meeting should be framed along those which were generally followed by international organisations like the UNESCO. Each section will have one Chairman and 2 Co-Chairmen. The Chairman will be appointed on the basis of the contribution he has made to that subject.

The Preparatory Committee noted with satisfaction that the arrangements for local hospitality for all the delegates in Delhi during the Symposium, are proceeding apace.

The meeting ended with a vote of thanks to Dr. S. Husain Zaheer.

The Editor does not accept responsibility for views expressed by contributors in this Journal

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