Vol. XX August 1968 No. 8

VIJNAN KARMEE

Journal of the Association of
SCIENTIFIC WORKERS OF INDIA

Annual Subscription
Individual Rs. 10.00
Institution Rs. 25.00
Single Copy Re. 1.00

Hundreds of thousands of innocent victims of Atom Bomb thrown on Hiroshima and Nagasaki in August 1945, who perished by the criminal abuse of achievements of nuclear science. Along with the rest of the peace loving people of all nations of the world, the Association of Scientific Workers of India renews its pledge to fight against the destructive use of nuclear energy and for complete disarmament.

Editorial

CASTASIA AND INDIAN SCIENCE

The Conference on the 'Application of Science & Technology to the development of Asia' (CASTASIA) held in New Delhi in August 1968 by Unesco was the third of the series, the previous two being in Lagos (Africa) in 1964 and in Chile (Latin America) in 1965. The guidelines were based on the recommendations of the Preparatory Committee of Asian Experts held in Ceylon in December 1966. Their primary recommendation was that major attention should be paid to the creation of national environments favouring the promotion of a scientific outlook and the application of science and technology to development. The Conference considered a whole range of subjects: creation of social climate favourable to science and technology, scientific education of women, technological education and training, role of the universities, scientific and technological policies, resources for research and development, scientific and technical manpower, policy and planning and has made a series of extremely important recommendations. The groundwork for the success of the Conference was well and surely laid by the document 'Basic data and considerations. prepared by the UNESCO (SC/CASTASIA/3) In its introduction the document lays great stress on establishing and strengthening the broad science foundation for the application of science and technology to development. It also points to the major lacuna in the system of evaluation of the scientific activities viz. the absence of reliable and comparable factual data and statistics on trained manpower and resources for scientific and technological activities in the countries of Asia.

It is but natural that many of the recommendations emerging out of such a Conference should have to be general in nature. Considering the uneven development of science and technology in various countries of the region, these would not be equally applicable to the conditions in different countries. The Unesco document divides the Asian countries into four groupings. In the first group occurs only Japan which has "strong government and private structure for coordination and support of research, a diversified network of institutions for higher education and execution of research as well as auxiliary services in the field of science and technology." In the second group occur countries where structures (government and private) for coordination of research do exist

as also the diversified operational network of institutions for higher education and research, the auxiliary services being in various stages of development. To this group belong India and Pakistan. To the third group belong countries where structures for coordination and support of research are not highly developed and where the network of institutions of education and research and auxiliary services is yet under development. This group includes Burma, Ceylon, Republic of China, Indonesia, Iran, Republic of Korea, Philippines, Thailand, Malaysia and Singapore. The last group of countries comprises of nations where scientific institutions for education and research are just to emerge such as Afghanistan, Cambodia, Laos, Nepal and Republic of Vietnam. Japan is amongst the world's most developed countries while India and Pakistan are in the middle stages of development. The rest of the countries are far behind. Even between Japan and India, there is considerable gap in regard to research, develoment and education. The sample mentioned in the document shows that Japan has a very large number of development engineering and resources development institutions. It also has a number of institutes on basic sciences. It even now spends more than 1% of GNP on research and development, which is the basic recommendation of CASTASIA for the developing countries to reach by 1980. Thus most of the recommendations of the Conference have no relevance to Japan.

So far as India is concerned, the recommendations have a great degree of importance. The Conference has recommended setting apart adequate funds for science popularisation and creating a proper climate and temper amongst the people to ensure receptivity to scientific ideas and promote development of science and technology. It has laid emphasis to improve the social status, image and career prospects of scientists and technologists with attractive salary scales and working conditions to minimise the loss of scientific and technical manpower through brain drain. It has pointed out the importance of women's organisations participating in the building up of scientific and technological potential. In the matter of universities it has emphasised the need for relating of the science education to the needs of development. One would wish that there had been some mention of the major shortcomings of the university teaching of science and engineering subjects in respect of the unsatisfactory student-teacher ratio and lack of adequate experimental and library facilities. Of particular importance is the recommendation regarding science literature with emphasis that the national educational system should include information about science and technology so that the broad base of the nation contributes in the development of its application.

Amongst the most interesting and important recommendations are those related to planning, science policy and overall organisation of research. It has been emphasised that the national science policy should extend in scope to the entire chain of activities ranging from basic research to innovation process whereby the results of research and experimental development are translated through engineering and design to the needs of immediate social and economic value. Economic growth and technological change should be oriented and sustained by the nation's own scientific and technological community. It is heartening to read that the CASTASIA has recommended steps to secure "effective participation of the research scientists and technologists in the growing organs of the national science policy-making bodies" and "to establish and expand Research and Development base such as laboratories, scientific equipment etc. in order to meet the needs of

national economy including the need for choice, assimilation and efficient utilisation of imported technology". The Conference has laid stress on surveys, studies and investigations on science policy in the developing countries and the development of scientific and technical potential (STP). One of the most important recommendations relates to financial resources for research and development. It states that most of the advanced countries are devoting sums of the order of 1-3% of their GNP on financing research and development while most of the Asian countries barely spend 0.1 to 0.3 % It has recommended that at a national level at least 1% of the GNP should be reached as soon as possible and not later than 1980. In the India context, considering the stage of development already reached, 1% will be too low. Of late there have been some retrograde trends against further investment in research which have tended to narrow the base of science and technology in the country. The CASTASIA recommendations should help reverse this trend. The Conference has asked the nations "to entrust the national science policy makers with the responsibility of working out on permanent basis the long term technological perspective and forecastings which is vital to modern national development planning". In the Indian context, this recommendation puts the responsibility of technological forecasting and science planning on the newly constituted Committee on Science and Technology . This Committee should be responsible for the entire gamut of research activities from basic research to innovation. For the first time, the activities which have so far been diffused under various organisations have been brought under a single advisory authority. There are some useful recommendations on indigenous research versus imported technology. In the initial stages, the expenditure on imported technology would be more than on indigenous research but this should be corrected by spending more on indigenous research than on import of technology. The Conference also recommends incentives to be given to local industries by way of preferential treatment, reliefs, subsidies if they develop technology comparable with that which would otherwise be imported. Japanese and Indian experiences show that this recommendation is neither adequate nor goes far enough. Actually in order to assimilate and further develop technology, expenditure on research will have to be many times more. Moreover, there has to be a graft of indigenous research with imported technology. State measures and policy decisions are needed to bring about a close contact between imported technology and indigenous research to ensure further development based upon local effort. Perhaps the most important recommendation refers to the methodology and concepts used for a model for Asia in regard to the collection of data on scientific manpower, research and development (R&D) and scientific potential. For the first time an attempt has been made to quantify scientific potential and ensure collection of facts and figures, data and statistics on a comparable basis through uniform methodology applicable to the countries in Asia. This suggestion is to be entirely welcomed because with this the first steps have been taken to ensure measurability of research and development in the Asian region and providing such stimulus and incentives as would promote speedy growth of science and technology and its application.

It would not be out of place to mention that India could have made a far better contribution and a much deeper impact if membership of the Indian delegation had been better chosen. The Indian press has been uniformally critical of the age group of the Indian delegation. Most of the delegates were on the wrong side of 60 and appeared somewhat odd in the youthful audience of delegates from other coun-

tries. Most of them were not even working scientists but administrators of some type or the other including one ex-Governor and two Secretaries of the Government. Most of the members of the delegation could hardly be expected to be conscious of the ambitions and feelings of the younger generation of Asian scientists. They also faced a natural difficulty in communication with members of the other delegations which were 20 or 30 years their junior. As a result the sharing and communication of Indian experience was inhibited. Where India could have provided leadership and fraternal assistance to the newer developing countries, the opportunity was missed. Another aspect which arises out of the selection of the delegation was that each delegate spoke for himself and there was no coordinated effort in putting forward an Indian policy based on the country's experience. The only outstanding contribution was by the leader of the delegation, Dr. Gadgil, whose able, balanced and mature presentation of the Indian policies and pointing out the difficulties faced by the country in implementation of the science policy created a deep impression. The fact that the Indian delegation did not include individuals who had direct experience of studies on application of science and technology, science planning, collection of data, facts and figures on Indian Sc enc deprived it of the quantitative basis for its statements. While in the panel of advisers there was a surfeit of people from the government departments and the Secretariat, it is difficult to understand why the younger scientists who have contributed to initiating studies on science policy, science planning were mysteriously left out of the delegation. The Indian delegation would have made a far better impression if the seniors had acted as advisers and younger scientists had been brought at the delegation level. The younger scientists would have moved more freely, gained by exchange of experience and built contacts that would have lasted through years to come.

However, the question now is of the future of the recommendations made by CASTASIA. The recommendations of the previous two conferences at Lagos and Chile have hardly been implemented. UNESCO has promised to organise a follow-up at the Unesco level and keep in contact with the various countries. At a national level, it is the governments of the respective countries that have the responsibility for the implementation of these recommendations. In India the recently set-up Committee on Science & Technology under the chairmanship of Dr. B. D. Nag Chaudhury which has a blend of youth and maturity should be able to bear the responsibility. May we expect that this Committee will put implementation of the recommendations of CASTASIA as its first task and make a report on the progress every year to the nation. Like this we can still make a headway to making the economic system of the country responsive to the stimulus of scientific research and development.

Frankly speaking

WHO IS QUALIFIED !

To Prof. A. B. Sen of the Chemistry Department of Lucknow University, belongs the doubtful credit of calling some of his fellow-scientists in CSIR 'under-qualified' (National Herald, August 11, 1968). What inspired a university teacher on the verge of retirement to jump in this unsavoury controversy, passes our comprehension? How qualified to talk with authority on its ailments is an 'academic professor' who had little to do and has never been associated with the working of this organisation? Part of the malaise of CSIR is due to the unwholesome advice by some university professors who have arrogated to themselves the monopoly of wisdom even in the sphere of industrial research and development. Not all the hundred and odd research papers over 25 years published by Dr. Sen on potential pesticides, amoebicides, fungicides have resulted in a single industrial product. As compared to this a B. Sc. in one of research institutes, starting his career as a Laboratory Assistant through sheer force of hard work, ingenious study and sterling ability perfected a process. He was promoted to Senior Technical Assistant's post, deputed to the industrial firm where his efforts resulted in an annual production of above Rs. 50 lakhs and that much saving in foreign exchange. The firm has offered to absorb him on a four-figure salary. To Prof. Sen, perhaps this scientist is 'underqualified'.

Perhaps Prof. Sen is confused! He is mistaking qualifications for ability. When some of the universities are known to have become 'degree manufacturing factories', superior claims of paper qualifications can only add to white collar unemployment. What the country needs in the sphere of industrial research and development is *ability* to produce worthwhile results capable of utilisation and not high sounding 'research papers' of little value. In the field of industrial liaison, operational research and science planning, what is needed is ability to understand the problems of industries, the gift of selling ideas, capacity to coordinate activities in different spheres and breadth of knowledge and information of social, economic and industrial fields. We doubt if Dr. Sen or some other 'qualified professors' would make a success in the above fields.

There was a time when foreign qualifications were given undue weightage. A B.Sc. or M.Sc. from af oreign university was preferred to a local Ph.D. It needed a powerful protest from the scientific community to register with the authorities that a foreign qualification does not automatically denote superior ability. Now Prof. Sen would have us believe that a Ph.D. or D.Sc. is necessarily superior in carrying out industrial research, development, liaison, information, planning and production than a scientist of proven ability even

if lesser 'qualified'. It is time that those who sit on selection committees realize that the merit of a scientist is to be judged on the basis of his ability and reputation with his compeers in his field of specialisation and not by paper qualifications and number of papers published. If the Selection Committees have a greater representation of Scientists from the industrial firms and lesser from the universities, this 'qualification aberation' would soon be corrected. The late Prof. J.B.S. Haldane considered over-emphasis on qualifications in scientific research as an evil like the caste system which can only create hurdles in the path of good scientists coming up. He said "I hope that steps may be taken to break it (university qualifications for research and promotion) before it exercises a paralytic effect in India as the old one (caste system)."

CASTASIA: Conclusions and Recommendations

A. CONCLUSIONS AND RECOMMENDATIONS ARISING FROM THE WORK OF THE COMMISSION

I. PREREQUISITES FOR THE APPLICATION OF SCIENCE AND TECHNOLOGY TO DEVELOPMENT

1. GENERAL CONSIDERATIONS

The Conference

Recognizing that the application of science and technology is a fundamental factor influencing the pace of economic development.

Mindful of the material and social benefits that accrue through the proper application of science and technology,

Believing that effective application of science and technology implies the existence of certain prerequisites, including the development of research institutes, the strengthening of facilities and programmes for training of workers and specialists in all fields of science and technology including agriculture, and the development of functional science literacy beginning withthe early introduction of scientific concepts in the schools and the general popularisation of science among the people.

Noting that the Government holds the ultimate responsibility for national development in all sectors,

1. DRAWS THE ATTENTION of the Member States of Asia to the fact that the establishment of the prerequisites for the application of science and technology to development within the context of the availability of human and natural resources of Asia both on the national and regional level require strong motivation, determination and direction on the part of the Governments of the region;
2. INVITES Member States to strive to increase the supply of available talent through assuring equality of opportunity to education;
3. INVITES the Member States to intensify their efforts in this regard through regional and international co-operation and collaboration, whenever and wherever needed.

2. SOCIAL CLIMATE

Popularisation of science

The Conference considers that the creation, of the awareness of science in the common man (popularisation of science) is a most important aspect in the creation of a social climate favourable to the application of science and technology to development.

—that the responsibility for the popularisation of science rests with the Government, the scientists and governmental and non-governmental organizations and universities. Scientists have an active part to play in convincing the Government to devote more resources to this purpose.

—that the problem of mass communication is a serious one, since much of the population of Asia is rural. The use of modern methods of mass communication should be investigated both to transmit information and knowledge and to make the public aware of possibilites.

Therefore, the Conference RECOMMENDS

1. (i) that all the developing countries in Asia take the initiative to popularise science among the people through use of mass media techniques, including audio-visual media, through museums, through extension lectures, through science fairs, through simple experiments and the like;

   (ii) that special attention be paid to the production of well-designed material in the language of the people, and in terms of their environment;

   (iii) that audio-visual means should not mean the use of expensive material like films, but should also consist of locally available material;

   (iv) that a special organization devoted to educational research and training be invested with the responsibility of designing models, charts, diagrams and other material for use in popularisation.

2. That steps also be taken to determine the right techniques in approaching the people and that the methods of dissemination should take into account the psychology of those for whom the programme is intended.

3. That Member States should undertake national compaigns through appropriation of adequate funds and by setting up science popularisation funds.

4. That the Scientific organisations in each country identify projects which already have high priority, for example rural development, or family planning, and use such activities for popularising science.

5. That the scientists of Asian countries contribute to the understanding of and commitments to science and technology through such means as voluntary service in the schools.

6. That Unseco assist the developing countries in this work in all ways open to this international organisation, and specifically.

   —that Unesco gather and disseminate information on techniques and demonstration material which have been effectively used in both developed and developing countries in the popularisation of science, that Unesco intensify its international programme to study methodology for the creation of a social climate favourable to the application of science and technology, and explore the possibility of an Asian campaign for the popularisation of science.

3. SOCIAL AND HUMAN FACTORS AND THE "BRAIN DRAIN"

The prerequisites for implantation and application of science and technology include, in addition to material and human resources, the fulfilment of a number of conditions related to cultural patterns and value systems and inter-individual and inter-group relations. There are certain essential requirements in recruiting, training and maintaining adequate numbers of scientists, technologists and technicians required for national development.

It is considered that the "brain drain", the migration of scientists and engineers away from the developing countries, is the result of social and human factors and it is recognized that the improvement of the present economic and social status of scientists and technologists accompanied by adequate facilities for research will help arrest this loss of national wealth. The recommendations in this Section are designed to allow scientists and technologists to play a more active part in development and at the same time to contribute to the reduction of "brain drain".

It is felt that Member States should for-

mulate their own policies for the absorption of scientists and technologists, keeping in view their national programme, and that arrangements for employment should be made well in advance, so the scientists are not encouraged to leave their countries, thereby minimizing the 'brain drain".

Therefore, the CONFERENCE RECOMMENDS:

1. That all possible measures be taken by Member States:

   (i) to improve the social status, image and career prospects of scientists and technologists including creation of scientific and technological service with attractive salary scales, and retirement benefits, and prospects of appointment to higher positions or at par with other cadres;

   (ii) to create additional courses in universities, research establishments;

   (iii) to facilitate job mobility among the various institutions employing scientists;

   (iv) to provide adequate research facilities in existing institutions and to enrich the possibilities for scientists:

   —by providing high-level fellowships for them to travel abroad, and

   —by establishing Centres of Advanced Studies and Research in the country with necessary equipment.

2. That careful attention be given to assuring that study programmes abroad be matched to the needs of the home country, thereby improving career possibilities.

3. That Unesco pursue a systematic and quantitative study on the actual data of migration of scientists and engineers in Asia and on the factors influencing such migration, national remedial measures hitherto taken, taking into account the previous studies which have been made on this subject;

4. That Unesco encourage the creation and strengthening of scientific and engineering societies and the promotion of international and regional co-operation in scientific and engineering fields.

4. STATUS OF WOMEN

It is noted that a tremendous amount of potential talent and genius of the women of Asia is not being effectively utilised now and it is recognized that women as scientists, mothers and homemakers can play a particularly significant role in the popularisation and advancement of science, both within the family and in society.

Therefore the Conference RECOMMENDS

1. that Member States give highest consideration to improving access of women to careers in science and technology (including engineering and agriculture) at all levels;

2. that Unesoco, its Member States and their National Commissions make still greater use of governmental and non-governmental women's organizations in carrying out its programmes;

3. that women's organisations in Asia be requested to encourage their members to take an active role in the popularisation of science within and without the context of family life.

5. ROLE AND RESPONSIBILITIES OF UNIVERSITIES IN THE IMPLANTATION OF SCIENCE

It is generally recognized that teaching and research are both primary functions of the university and that there should be a close relationship between these functions. This relationship may vary considerably between

countries, depending on their stage of development. It is suggested that at early stages of development, wherever possible, scientific activities be concentrated around a university, as the institution which must provide the scientific succession, and that there be flexible arrangements whereby professors can take part in the work of Government laboratories and industrial establishments, and scientists in Government and industry can take part in teaching. The overriding consideration at this stage is to make the best possible use of a limited number of scientists and limited facilities.

As development progresses the research role of the university continues to be strong, although some specialised research activities may most effectively be carried out in research institutes.

The role of the university in teaching and research is clear. Recognition should also be given to its role in other areas, such as providing leadership in community development.

Therefore the Conference RECOMMENDS

1. That Centres for Advanced Studies and Research be established at certain universities as a means of strengthening the environment for research;
2. That consideration be given to greater utilization and exchange between universities of the region;
3. That a proper balance between research, teaching and industrial activities be aimed at eliminating competition for scarce scientists between the universities. Government research establishments, and industry (including agriculture) while maintaining close co-operation between them;
4. That the development of leadership in science be stimulated through special measures, possibly in connexion with the Centres for Advanced Studies and Research;
5. That the volume of university research activity be increased towards the level where such activity can become self-sustaining, through such measures as:
   (a) Giving priority to research in areas for which developing countries are particularly suited, for example: tropical agriculture, weathering of tropical rocks, etc.;
   (b) Arranging that their outstanding scientists be given opportunities to work at world research centres periodically;
   (c) Creating regional research centres to deal with problems of a region character such as meteorology.
6. That a regional advisory committee composed of university, governmental professional and institutional representatives be set up with a view to reviewing and advising on degree requirements of Asian universities and moving towards regional degree standards.

6. TECHNICAL AND TECHNOLOGICAL EDUCATION / TRAINIING

The primary aim of technical and technological education and training is to develop a creative mind with a keen sense and feeling for the application of knowledge and "know-how".

In most Asian countries there is a shortage of trained engineers, technologists and technicians and in some cases an imbalance in the ratio of available engineers and technicians, as a result of which, capital investment does not bring the desired result because of low productivity.

Therefore the Conference RECOMMENDS

1. That special attention be given to the

training of technicians both in terms of number and quality.

2. That steps be taken to improve facilities for practical training in industry as an important part of engineering and technological education.

3. That attention be paid to the need for referesher programmes for working engineers and technologists , through part-time study and correspondence courses. For this purpose, the setting up of teaching centres in selected establishments is recommended.

4. That part-time, "sandwich" or evening courses be organized in co-operation with industry.

5. That in the development of technological education and training, particular attention be paid to the timing of specialization; early narrow specialization is not advisable for countries at lower stages of development where job opportunities are limited.

6. That Unesco undertake a survey of the work being done by various international and bilateral agencies in the field of technical and technological training with a veiw to minimizing duplication.

7. That in view of the continual changes in technological and technical education and training, Unesco study the possibility of undertaking a project to evaluate and update the content of engineering curricula.

8. That Unesco study the possibility of setting up a regional advisory committee composed of governmental, professional and institutional representatives with a view to establishing standards for engineering and technician qualification in Asia with the ultimate object of international recognition and acceptance of these qualifications.

7. PROMOTION OF TECHNOLOGICAL SCIENCE AND APPLIED RESEARCH

It is recognised that Applied Research Institutes have a critical role to play in development. It was felt that they must develop particularly close contacts with industry, and that to facilitate this they should have development sections. The role of universities in applied research and the need for an adequate supply of technicians were stressed.

Therefore the Conference RECOMMENDS:

1. that applied research institutes develop research links with similar institutes in developed countries through "twinning" arrangements;
2. that special attention be paid to the dissemination and various steps in utilization of the results of applied research;
3. that advisory bodies be established including representatives of universities, government and industry to assist in planning research programmes and assuring use of research results;
4. that consideration be given to setting up specialized regional research institutes in appropriate fields so that resources and staff could be pooled, and training could be organized on a co-operative basis.

On the question of international co-operation it was noted that there are many agencies working in the field of technological sciences and applied research, and it is recommended:

5. that Unesco in collaboration with other United Nations organizations initiate or undertake to review the work of the various groups with a view to co-ordinating such activities and integrating them into development planning.

8. AGRICULTURAL EDUCATION AND RESEARCH AS PREREQUISITES FOR THE APPLICATION OF SCIENCE AND TECHNOLOGY TO DEVELOPMENT

It is recognised that as rural economy and agricultural production play the major

role in national life of almost all Asian countries in terms of GNPs as well as in socio-economic and cultural patterns, modernization of agriculture is one major and essential prerequisitie to development and rural transformation.

Therefore the Conference RECOMMENDS:

1. that Member States should take as a matter of urgency positive measures to strengthen agricultural education as integral part of the National Education Plan, and apply a multi-disciplinary approach to both basic and "problem oriented" agricultural research programmes in order to bring about a full awareness of the implication of the application of science to the development of agriculture and a determination to increase agricultural production;
2. that additional chairs be established for applied and basic sciences such as agricultural botany, agricultural chemistry etc. within the university departments or faculties of related basic sciences;
3. that close collaboration should be maintained between departments of basic sciences and agricultural research with the object of sharing spectroscopes, computers or such other expensive pieces of equipment and other common services (library, museum, etc.);
4. that in appropriate environments universities should engage themselves in agricultural education and research; and extension in an integrated manner;
5. that all education, especially at the university and teacher training levels should include some treatment of agricultural problems with a view to encouraging young men and women take up scientific and technical agriculture as a career;
6. that due to the need for a greater number of middle-level technicians as farm-leaders and extension workers, the establishment of multi-purpose polytechnics-having sufficiently diversified courses be considered;
7. that demonstration in the farmer's fields be used as most efficient means of transferring the results of agricultural research to the farming community;
8. that examples from rural environment and life in the country itself should be included in science teaching and curricula at schools and colleges.

9. THE INFRASTRUCTURE OF AUXILIARY SERVICES

There is general recognition of the importance of auxiliary services such as documentation, standardization and instrumentation, and it is noted that the attention paid to these prerequisites is seldom adequate.

Therefore the Conference RECOMMENDS:

1. In the field of scientific and technical documentation and information,
   that efforts should be made to rationalize subscription procedures and to make full use of abstracting and reproduction services,
   that Member States co-operate with Unesco and other international agencies by making available reliable and international comparable statistics in the field of science and technology, that Unesco should study the possibility,
   (i) of establishing a regional clearing-house for scientific information, possibly through strengthening the role of national centres and the regional centres for science and technology.
   (ii) of establishing a regional network of information and documentation centres based on existing centres.
   (iii) of sponsoring a small committee of experts to consider methods of

coping with the non-availability of expendable supplies (e.g. photographic paper) to Asian documentation centres.

2. In the field of standardization,

that the countries of the region give due regard to the need for the establishment of basic and industrial standards and recognize that advice and assistance are available to them through the various agencies and organizations working in this field,

that Unesco should continue its co-operation with ISO, UNIDO and ECAFE in the establishment of training courses in standardization.

3. In the field of instrumentation,

that systems of inventory control be developed to improve utilization of instrumentation services,

that recognition be given to the problems caused by lack of spare parts and that Unesco should continue to allocate budgetary resources for this purpose, as foreseen in the decision of the fourteenth General Conference,

that Unesco continue its activities in building up instrument facilities in Asia, particularly the regional network of instrument centres.

II. THE IMPROVEMENT OF SCIENCE EDUCATION IN THE COUNTRIES OF ASIA

1. GENERAL CONSIDERATIONS

1.1 It was noted that on the basis of present trends as outlined in the "*Asian Model of Educational Development: Perspectives for* 1965-80" several countries are not likely to achieve universal primary education by 1980 and that the differences in the levels of educational facilities and rates of literacy between these countries and others would widen even further over the next two decades.

The Conference RECOMMENDS that

(i) Special measures should be taken to mobilise national and international resources and assistance so that these countries are able to develop at least the minimum essential facilities for basic education, thus laying the foundation for their scientific and technological development.

1.2 Science education is the principal means particularly in the developing countries for transmitting scientific literacy to a broadening stream of population as well as for creating the scientific and technological manpower necessary and indispensable for economic and social advance. Science education policy should therefore be viewed as an integral part of a national education development policy, of which it is a leading sector.

The Conference RECOMMENDS that:

(i) Member States give high priority in their national development programmes by allocating adequate financial and other support to teaching and research in the basic and applied sciences and mathematics;

(ii) Member States in Asia take urgent action to prepare systematic and detailed plans for the expansion and improvement of science education at all levels with a view to meeting the emerging needs of economic and social development;

(iii) Member States lay stress also on technical education at secondary level and the training of technical and vocational teachers and technicians.

Invites Unesco and other multilateral and bilateral agencies

(i) to give high priority to projects of scientific and technological development in their programmes of assistance;

(ii) to help Member States on request through technical and advisory missions, in their planning of science education programmes.

1.3 While scientific knowledge is a common heritage of all nations, science education has to have relevance and significance to the needs of society and of national environment of which the national languages are the natural expression. The use of national languages for instruction in scientific studies willl also ensure a broadening of access to scientific knowledge and education. At the same time science education policy should be so designed that the links with the international heritage of scientific knowledge are maintained and strengthened.

The Conference RECOMMENDS that

(i) While the use of national languages for science education is being promoted, measures should concurrently be taken for developing the national languages with respect to the production of scientific literature and modern scientific and technological terminology;

(ii) the Roman alphabet be taught at the primary stage to familiarize the pupils with the universal symbols of scientific and mathematical thought which reflect the universality of science itself.

Invites Unesco

(i) to undertake and publish an expert study on the basic principles and techniques by which international terminology on science and technology can be introduced into the national languages;

(ii) to use its good offices to secure for Member States from countries where advanced scientific publications in various disciplines are available, facilities for the reproduction, translation and adaptation of scientific books in their national languages, notably by facilitating copyright permissions and creating a "Copyright Bank";

(iii) to study the possibility of preparing an international glossary of scientific and technological terms.

2. IMPROVEMENT OF SCIENCE EDUCATION

2.1 Science should be an integral part of both primary and secondary education. The programme for the improvement and modernization of science teaching should include the curriculum, evaluation procedures, teacher preparation, teaching methods, instructional materials, laboratory and equipment, for all levels of education.

The Conference RECOMMENDS that

(i) the teaching of science, in a form appropriate to the maturity level of the pupils, should be started at the earliest stage and continued as an essential part of the general education of every pupil in the first ten grades.

(ii) at the primary stage the emphasis should be on inculcating a scientific outlook rather than memorisation of facts and the teaching of science should be centred on the direct experience of the pupils and related to their environment; the learning ex-

periences should be broad-based and particular attention should be given to themes related to conservation of natural resources, nutrition and health,

(iii) the production of books in national languages (including textbooks) on scientific subjects should be increased rapidly in order to make available to children in schools a wide range of reading materials written to suit their interests and needs,

(iv) at the lower stage of the secondary level, a practical work programme centred round vocational including, where necessary, agricultural operations and develoment of local arts and industry be made a part of the general education of all pupils.

Invites Unesco

(i) to arrange for the preparation and publication of Source Books of Science Teaching Materials designed specially for primary school children;

(ii) to consider organizing suitable training programmes at the regional level in the development of improvised or low-cost teaching materials suitable for use in primary schools.

2.2 Considering the stage of educational development that most countries in Asia have reached and the pattern of their manpower needs, education at the secondary level, and specially the teaching of science, occupies a pivotal position. Therefore improvement of science education in secondary institutions is essential for preparing adequately students for higher institutions as well as for laying a sound foundation of basic scientific knowledge for pupils intending to proceed to vocational, technical and technological studies.

The Conference RECOMMENDS that

(i) Science curricula should be reappraised and revised. Due attention should be given in the courses to the practical and applied aspects of the subject, as well as to its relevance to the problems of the environment and in revising the courses, attention should be directed to incorporating in a suitable form new developments in scientific knowledge.

(ii) Because of the urgency of a rational understanding by all people of the issues involved in the population explosion, the subject of *population science* be included in the syllabus of science that is taught in all schools at the late primary and secondary levels.

(iii) Member States establish, or where it already exists, strengthen a national institutional framework for *educational research* and development. Within this framework, high priority should be given to science education programmes which would include the following components:

(a) Science curriculum research and development;

(b) guidance, examination and evaluation procedures;

(c) the design of apparatus and equipment, and prototype development;

(d) the planning of science laboratories and workshops;

(e) the design of teaching aids, in particular mass media programmes;

(f) research in and development of instructional materials including

text books and curriculum guides;

(g) the organization of in-service training of science teachers and supervisors; and

(h) the organisation, technical guidance and evaluation of pilot projects and the conducting of field-trials of new programmes.

(iv) Projects embodying improved science programmes and adapted to national and local conditions should be designed and carried out through selected schools. The results of such pilot projects should be carefully and continuously evaluated through appropriate "feed-back" mechanisms and the new programmes should be progressively expanded throughout the school system.

(v) For research and development in science education it is essential that some selected schools should be developed as experimental schools and given considerable freedom from the normal departmental controls.

(vi) University and research scientists should be closely associated with the development of new science proggrammes.

(vii) Considering that most Member States in Asia have to import their requirements of laboratory equipment using foreign exchange resources, it is essential that high priority be given to the designing and manufacturing of laboratory equipment either through State-owned enterprises or private manufacturers. At the primary and lower secondary levels simple equipment improvised or made from indigenous material, but with high instructional value, should be used in the teaching of science. At the secondary level also there is room for considerable simplification and lowering of cost in laboratory equipment design. It is specially important that in matters relating to equipment close co-operation be maintained between industry and schools. Use should be made of mobile laboratories to demonstrate experiments which need expensive apparatus and for the training of teachers in handling it. Development of science museums and science clubs should be considered an essential part of the science education programme and as means for creating opportunities for young people to explore their scientific interests outside the school.

(viii) Urgent attention should be given to the production of scientific books and journals and to the development of science libraries for use of pupils as well as of teachers.

The Conference INVITES Unesco to consider the following measures:

(i) Where national institutions for educational research or equipment designing and production have been established and are being strengthened or new institutions are being set up, technical assistance be given as a high priority for the development of science programmes within the framework of these institutions, notably by securing assistance from the Special Fund component of United Nations Development Programme;

(ii) Considering that many Member States in the region have established national science centres or units, or are developing national science education programmes, there is need for

a regional institutional framework for linking these activities in a network of co-operative action. Such regional institutional framework should be designed to render clearing house and promotional services in key areas of activities such as curriculum development, teaching methods and organization of workshops for the training of key personnel in science and technical education.

(iii) Programmes in science education should also be built into the programmes of the existing Regional Institutes sponsored by Unesco, notably in the areas of training of teacher educators, educational planners, school building designs and educational research.

(iv) Some countries in the region have established their designing and production centres for laboratory equipment. Arrangements may be made with the Member States concerned to secure that the services of their centres are made available to other Member States in the region by supplying the designs and prototype models, as well as through training programmes.

(v) A systematic programme should be developed for organizing regional workshops, seminars and conferences for exchange of experiences acquired in the various national projects. Participation of those who are associated with similar projects outside the region should also be facilitated and secured.

(vi) A programme should be developed to enable key personnel in Member States to visit other countries in the region and study their new programmes in science education.

(vii) A study group should be established to make recommendations concerning the details of courses in population science that might be effectively taught in late primary and secondary stages of education.

3. TEACHER TRAINING AND RETRAINING

3.1 The teacher is by far the most important factor in any programme of educational development. If the teacher is not qualified, trained and motivated to carry out a new programme of science education, the programme is unlikely to have any effect on the schools or pupils.

The Conference RECOMMENDS that:

(i) A continuous upgrading of the basic and professional qualifications of teachers and supervisors should be the first concern in implementing a programme which calls for a higher level of insight and professional skills.

(ii) In-service training of teachers and supervisors through summer institutes and vacation as well as regular courses, both in subject content and methodology should be systematically undertaken.

(iii) The professional training of primary school teachers should include study of science as an obligatory subject.

(iv) Recognizing that subject-content and the methodology of teaching it are closely connected, the professional training of teachers should be so organized that scientific knowledge and professional insights are developed concurrently.

(v) Opportunities should be provided for science teachers in schools to keep in touch with the widening horizons in their fields of specialization through special courses and through working with University teachers and research scientists.

(vi) The side gap between teachers working at different levels of education should be progressively reduced and opportunities for vertical movement by promotion of qualified teachers from one level to another should be created.

The Conference INVITES Unesco to consider the following measures:

(i) to study the feasibility of establishing at the regional level high quality correspondence courses designed for upgrading the scholarly and professional competence of secondary science teachers;

(ii) to undertake and organize special programmes for the training of teacher educators and supervisors of science.

4. SCIENCE AT THE UNIVERSITY LEVEL

4.1 In the present stage of development of Asian countries, the pace of scientific growth is conditioned primarily by the state of science education in the Universities. Here quality and excellence should be supreme: without them the supply of high level scientific manpower for research, teaching, industry, agriculture and all other productive sectors of national life will be vitiated at the source.

The Conference RECOMMENDS that:

(i) To meet the demand for qualified faculty staff arising out of rapidly expanding enrolments, urgent attention should be given to developing and strengthening post-graduate and doctoral programmes in the universities.

(ii) Summer schools, workshops and seminars should be organized regularly in which teachers of different subjects are brought together under the guidance of competent professors and scholars from within and outside the country, to study new developments in their disciplines.

(iii) Considering the competitive demands on the limited supply of qualified scientific manpower, studies should be made and measures taken to ensure the most effective deployment of available personnel among the various fields of productive activities, recognizing the needs of teaching, research, industry, agriculture and other productive sectors of national economy.

(iv) In order to ensure within the institutions of higher education an awareness of the needs of industry and agriculture, these institutions should give equal weight in making appointments to achievement in these spheres and to academic distinction.

(v) For using effectively the available opportunities for training abroad, it is essential that careful attention be given to match the programmes of study abroad to the needs in the home country.

(vi) Facilities for scientific and technological research including research in applied sciences be improved in terms of equipment, salary incentive and conditions of work.

(vii) In order to ensure optimum use of resources and staff and develop stan-

dards of excellence, advanced centres of study in specialized fields be created for the training of high level specialists. These centres of excellence be helped and encouraged to make their facilities available to students from Member States in the region for study and research at postgraduate and doctoral levels, establishing for this purpose, and within their institutional framework, special programme sections for regional studies.

(viii) The universities be actively encouraged to enter into co-operative arrangements with other universities in the region, on a bilateral or multilateral basis, in order to promote joint studies and research on problems of common interest or topics which reach beyond national boundaries, and to this end Member States give financial and other support to them.

INVITES Unesco to consider the following measures:

(i) Assistance in the training of high level faculty staff by increasing the fellowship programmes may be given immediate attention.

(ii) In view of the lack of correspondence that often exists between the training and skills acquired in overseas countries and the types of jobs that need to be done in the home country, a committee of experts be organized to study ways of closing the gap between training received and available employment.

(iii) Member States be assisted, on request in developing centres of advanced study in selected universities at the national level.

(vi) Selected national centres of advanced study should be assisted to develop training and research facilities for the region and undertake research projects on a co-operative basis, and a plan in this regard be studied urgently.

(v) Member States be given technical assistance, on request, for their programmes of summer-schools and workshops.

III. SCIENCE POLICY AND ITS RELATION TO NATIONAL DEVELOPMENT PLANNING

1. THE PLANNING OF SCIENCE POLICY AND OVERALL ORGANIZATION FOR RESEARCH

The Conference,

Recognizing the role of a driving force that science can play in many sectors of national life and government policy, and in particular the decisive influence that the application of science and technology has on economic growth and social change, thus affecting deeply the course of the national development;

Considering that, for Asian countries, most significant and far-reaching science policy decisions bound to influence the course of their future scientific developmen are urgently needed;

RECOMMENDS to governments of Asian countries:

1. To formulate and implement a purposeful national science policy as a high priority measure in any government programme;

2. To extend the scope of their science policies to the whole chain of activities ranging from basic research to the innovation processes whereby the results of research and experimental development are translated through engineering and design into products

and techniques of immediate socio-economic value;

3. To recognize, as a basic option of their national science policies the principle of "endogenous development" whereby economic growth and technological change are being oriented and sustained by the nation's own scientific and technological community;

4. To ensure appropriate integration and harmonization of the national science policy at the highest level of government, while attaching major importance to the adjustment mechanisms of the science planning system which should provide for immediate reaction to error or changing circumstances;

5. To secure effective participation of the research scientists and technologists in the governing organs of the national science policy making bodies;

6. To create or maintain strong government structures for the formulation of scientific policy as well as for the coordination, financing and performance of Research and Development, and related scientific activities;

7. To establish and expand the Research and Development base such as laboratories, scientific equipment, etc. in order to meet the need of the national economy, including the need for choice, assimilation and efficient utilization of imported technology;

8. To formulate the national science policy in such a way as

(a) to create favourable conditions for the application of science and technology to national development;

(b) to reduce social disparity or adverse side-effects when adopting new technology, and in particular not to aggravate unemployment;

9. To adopt, publish and keep under constant review, a set of basic criteria for the allocation of national resources to science and technology, and in particular to Research and Development activities;

10. To promote, as a priority sector of the national science policy, the development of adequate scientific and technical information organizations and services at the national level.

2. STUDIES ON THE PLANNING OF SCIENCE POLICY

The Conference,

Recognizing the work accomplished by Unesco in surveying on a world-wide scale the national science policy-making bodies,

Noting in particular its current publication on such organisations in Asia and Oceania,

Considering that such information constitutes a valuable tool for analysing and comparing the institutional structures of national science policy-making,

Considering that special attention should be devoted to investigating their actual methods of operation and assessing their achievements, in order to analyse any structural or operational deficiencies,

RECOMMENDS to Unesco :

1. *To pursue* its work on the World Survey of National Science Policy-Making Bodies and to revise this survey information periodically;

2. *To undertake* studies on the operational and functional aspects of these bodies;

3. *To devote* particular attention in such studies to analysing the practical difficulties encountered by these bodies in carrying out their task;

4. *To advise* Member States upon their request on improving their Government bodies entrusted with science policy making and coordination of research.

3. DEVELOPMENT OF THE NATIONAL SCIENTIFIC AND TECHNOLOGICAL POTENTIAL OF ASIAN COUNTRIES

A. Human resources

Recognizing that human resources constitute the most important element for the scientific development of countries, in particular Asian countries,

Considering that manpower planning and manpower utilization are important factors to be taken into account in human resources development,

Noting the manpower planning model (the CASTASIA Model) prepared by Unesco in this respect, and

Considering that this model may be taken as a useful attempt at quantifying objectives for future development and utilization of scientific and technical human resources,

Recognizing that present working conditions offered to the scientists and the lack of opportunities for communication with their scientific colleagues of other countries in particular Asian are partly responsible for the brain drain phenomenon,

Considering that the present lack of middle-level qualified personnel affects the efficient utilization of what highly qualified manpower resources there are,

RECOMMENDS to governments that:

1. Special attention be paid to developing the human element of their scientific and technological potential;

2. The experience acquired by some Asian countries, especially the more advanced, in planning their scientific and technological manpower be shared with all countries and that co-operation in this field be set up on a regional basis;

3. Exchange of scientists between developing countries be encouraged;

4. Special attention be devoted to fully and appropriately utilizing the training already "invested" in the specialists and in particular that consideration be given to providing professionals with an appropriate number of support personnel;

5. In this respect, priority should be given to promoting training facilities for technicians, operators and skilled workers, for which task the collaboration of technical institutions, industrial enterprises and universities should be encouraged, and to giving proper status to these personnel;

6. They encourage directors of co-operative, sponsored and private industrial research laboratories to take steps in standardizing working conditions and salaries of research workers in the various types of organizations that are competing for their services, in order to avoid the "internal" brain drain phenomenon.

RECOMMENDS that Unesco:

1. Pursue its work on models and in particular the CASTASIA Model for Scientific and Technical Manpower" with a view to improving the applicability of such models to national situations, giving special attention to standardization and definitions in order to ensure the comparability and compilability of science statistics.

2. Expand its assistance to Asian Member States for the training of scientific and technical personnel.

B. Institutional Resources

The Conference,

Recognizing the need for information on research facilities in Asian countries in order to assess the state of scientific development of the region;

Noting the preliminary survey carried out and published by Unesco on Research Facilities in Asia;

RECOMMENDS that Unesco maintain a permanent survey of research facilities existing in the Asian countries with a view to facilitating regional co-operation and to providing regional organizations such as ECAFE, the Asian Development Bank and the Asian Productivity Organization with a consolidated assessment of the scientific and technological potential of the region. The services of the Unesco regional centres for science and technology in Asia should be utilized as far as practicable for collecting the data and maintaining the survey permanently up to date.

C. Financial Resources

The Conference

Noting that the most advanced countries are devoting sums of the order of 1% to 3% of their GNP to the financing of research, experimental development and related scientific activities, while in Asia the financing effort is at present, for most countries, of the order of 0.1%—0.5% of their GNP.

Considering in particular that in determining the national science budget a distinction should be made between the "intrinsic basic science budget", covering pure fundamental research undertakings, and the overall science budget, covering in addition all those research or development undertakings serving objectives, economic, social or political, which lie outside science itself.

RECOMMENDS that Governments of Asian countries

1. aim at reaching a minimum level of total national expenditure on research and development of 1% of their gross national product (GNP) as soon as possible, and hopefully not later than 1980;

2. carry out studies on the structure of their science expenditures and budgetary allocation mechanisms and in particular devote special attention in surveying their scientific and technological potential, to measurements of expenditure for research, experimental development and related scientific activities.

RECOMMENDS that Unesco

1. Provide assistance and guidance to Member States upon their request to carry out the Survey of their National Scientific and Technological Potential (STP);

2. pursue actively its world programme of collection of science statistics, particularly in the Asian region;,

3. initiate studies on the so-called "research exchange rates" in order to enable in future more realistic international comparison of rational expendiures for research, experimental development and related scientific activities.

4. SCIENCE POLICY IN RELATION TO OVERALL NATIONAL DEVELOPMENT PLANNING

e o e e

Recognizing that national science policies of Governments are to be integrated with the national development plans;

Convinced that a continuing institutional dialogue between science policy-makers and socio-economic planners is an essential characteristic of government in a rapidly changing world;

RECOMMENDS to the Governments of Asian countries:

1. To ensure that national goals are being translated into scientific missions, wherever appropriate, by the responsible national scientific policy-making bodies;

2. To secure the resources needed for the research projects derived from these scientific missions and to scrutinize the scientific coherence of the various research projects;

3. To identify bottlenecks in human financial organizational or informational resources which stand in the way of proper implementation of the research and development projects;

4. To make full use of the possibilities for international co-operation and assistance, in particular those provided by the United Nations Development Programme and the competent UN Specialized Agencies, to overcome obstacles in the implementation of the National Research and Development Programme;

5. To maintain a science section in the national development planning agency so that the science policy decisions are carefully integrated in the overall national development while the necessary resources for a vigorous development of the nation's scientific and technological potential are being secured in a regular and steady way;

6. To entrust the national science policy makers with the responsibility of working out, on a permanent basis, the long-term scientific perspectives and technological forecasting which is vital to modern national development planning.

5. ON INDIGENOUS RESEARCH VERSUS IMPORTED TECHNOLOGY

The Conference,

Noting that Asian countries which are in the initial stage of industrial development and others which are comparatively more industrially advanced are likely to have different approaches to the question of industrial research vis-a-vis foreign licenses;

Taking into account the respective interests of these two groups of industries, in promoting greater economic development as well as increasing self-reliance among these groups of industries.

RECOMMENDS to the Governments of Asian countries which are in the initial stage of industrial development and are aspiring for rapid economic growth through industrialization:

to ensure the free flow of imported technology, expenditure on this account may be at least equal to or indeed much more than that spent by such countries on their own research and development;

FURTHER RECOMMENDS to the Governments of Asian countries which have already established an adequate industrial base in various sectors of the economy:

1. *to take steps to spend* more money on indigenous research and development in such sectors, than on import of technology;

2. *to take steps to provide* incentives for local industries in order to make them more self-reliant, in particular by granting those local industries preferential treatment of a fiscal and financial nature such as tax reliefs, subsidies, etc. Such preferential treatment should be accorded to industries which intend to commercialize know-how developed by their own efforts as compared to other industries which have been established with foreign know-how and which continue to depend for further development on imported technology. The preferential treatment would apply only in those cases where the industries concerned have developed technological know-how of comparable nature, efficiency and level as the alternate foreign technology.

6. SCIENCE POLICY AND TECHNOLOGICAL INNOVATION

The Conference

Recognizing that the accelerating pace of scientific discovery increases the possibility of technological innovation which can cut production cost and make new products available;

Considering that expenditure on innovation is many times greater than the expenditure on the research and development work from which it arises, thus demanding a strict organization and management of the innovative activity;

Considering further that a need now arises in Asian countries for institutionalizing the promotion of innovation,

RECOMMENDS that governments

1. Formulate a policy for encouraging and supporting innovation and that this policy be carried out by specially tailored institutions together with productive enterprises and applied research laboratories; that they encourage the establishment of a closer relation between university research and the industrial community;

2. Study the feasibility and appropriateness of creating so-called innovation research and promotion centres to help them formulate and implement their technological innovation policy;

3. Seek the co-operation of the top management of science-based industrial enterprises in setting up this policy;

RECOMMENDS that Unesco and other United Nations agencies in co-operation with ECAFE,

render its assistance by investigating practical ways of establishing these innovation centres which would be entrusted with a broad mandate of application of science and technology to development. These innovation centres would have to be truly operational and would have to perform the role of national (or sub-national) development agencies mainly geared to technological progress and innovation.

7. INFORMATION IN THE INNOVATION PROCESS

The Conference

Recognizing the importance of information and documentation services in the innovation process;

Recognizing that in this field Asian countries face a critical situation and that they feel a pressing need for creating new, or improving existing, information and documentation centres.

RECOMMENDS that Governments of Asian countries

1. develop as a matter of priority an organization for scientific and technical information service at the national level;

2. find new ways of exchange of information between developed and developing countries especially in the field of industrial application of science and technology;

3. extend the scope of scientific documentation centres to cover also technical documentation in all fields.

RECOMMENDS that Unesco provide its technical assistance to countries of the Asian region, upon their request, in building up their scientific and technical information services and to extend the responsibilities of existing science documentation centres to all fields of technology, and that it provide arrangements for accelerating the exchanges of such information in the region.

8. INTERNATIONAL CO-OPERATION AIMING AT THE INTEGRATION OF SCIENCE-TECHNOLOGY AND PRODUCTION IN THE COUNTRIES OF ASIA

The Conference,

Noting that international and regional co-operation in matters relating to national scientific policy have not yet been developed at a satisfactory level in the countries of the Asian Region;

Considering that such co-operation could be highly beneficial to the promotion of science and technology in those countries.

RECOMMENDS to Governments of the Asian countries, to Unesco and other competent organizations of the United Nations system: and in particular ECAFE,

1. To organize, promote and facilitate international and regional co-operation aiming at the integration of science, technology and production in the various countries of Asia. In this connexion, the Unesco Regional Centres for Science and Technology should play an important role and should therefore be strengthened.

2. To arrange for more detailed collaboration in planning as well as in exchange of information and experience among countries of Asia in matters relating to their national scientific policies, in particular through.

(i) Meetings of governmental science policy experts periodically convened by Unesco in the Asian Region;

(ii) Surveys conducted by Unesco on the science policy making bodies and research facilities in the countries of Asia; these surveys should be related to the World Economic Surveys conducted by the United Nations;

(iii) Studying the possibility of establishing a regional clearing house for scientific and technical information needed for science policy planning.

3. To investigate the ways and means of pooling the scarce resources of Asian countries in personnel and material; in particular, Unesco should undertake a study of the actual possibilities for exchange of scientific and technical manpower between Asian countries.

4. To investigate the possibility of extending systematically the establishment of bilateral institutional links between scientific institutions of different countries.

5. To initiate or expand international and regional co-operation in all fields where far-reaching and useful results may be expected through the pooling of experience and research facilities, including mineral and ground water surveys, oceanology and hyrobiology, and the peaceful utilization of space.

IV "CASTASIA MODEL"

1. METHODOLOGY AND CONCEPTS USED IN THE CASTASIA MODEL

The Commission noted the flexibility of the method which can simulate the dynamics of future consequences of changes in any quantifiably defined conditions affecting scientific and technical manpower and R and D costs. It also welcomed the manner in which it provides a direct link between educational planning, scientific and technical manpower supply and R and D activities. Hence, it may be used by national policy makers and planners. The Commission also considered the advantages, for international comparability, of the wide use of such a standard method, flexible enough to be adapted to the varying conditions and objectives of different countries.

The Commission RECOMMENDS:

A. Member States:

1. To encourage the appropriate institutions and organizations to consider the metho-

dology used in the CASTASIA Model and to evaluate the results obtained with it;

2. To exchange experiences in the implementation of these and other new techniques and methodologies;

B. Unesco, at the request of Member States:

1. To conduct studies and adapt the CASTASIA Model for long-term national planning;

2. To improve and develop the methodology through pilot projects, expert meetings, workshops and aid to Member States;

C. Unesco:

To initiate projects using such approaches to link educational planning objectives and science policy objectives through the analysis of human resources potential.

2. THE CASTASIA MODEL AS A SCHEME FOR QUANTIFYING OBJECTIVES

The Commission discussed the assumptions used in the CASTASIA Model and the resulting quantitative objectives in the fields of scientific and technical manpower, R and D manpower and R and D costs. It was considered that the values of the parameters used reflect the present situation and indicate possible objectives for the region as a whole concerning the scientific and technical manpower supply. The Commission recognized that these objectives are mainly dependent upon the fulfilment of the educational objectives approved in the Asian Educational Model. The Commission considered the two alternative Educational objectives for R and D manpower and concluded that they constitute a useful framework for establishing national priorities. It did not feel that it was appropriate to select one or the other alternative as a regional objective believing that this choice should be made in the light of national conditions. As far as R and D costs are concerned it was concluded that while representing a reasonable average, national costs vary more widely between countries in the region than do the other variables used.

The Commission RECOMMENDS:

A. The Conference:

To consider the CASTASIA Model as a useful scheme for quantifying objectives for future regional development and utilization of scientific and technical human resources, including R and D activities;

B. Member States:

1. To consider the utilization of use of the CASTASIA Model, adapted as necessary to national conditions and objectives within the framework of a clearly defined science policy for the development and utilization of scientific and technical human resources;

2. To identify their scientific and technical manpower needs and study the alternative ways of meeting them;

C. Unesco, in collaboration with other United Nations Agencies, at the request of Member States:

To assist in the establishment of national quantitative objectives for the development and utilization of scientific and technical human resources:

D. Unesco:

1. To conduct a periodic review of the scientific and technical human resources achievements, including R & D activities in the region, in its possible relation to the CASTASIA Model.

2. To maintain close co-operation with the ILO to ensure coordination between the ILO Asian Manpower Plan and the CASTASIA Model including possible

modification in the light of the assessment of the demand for scientific and technical manpower in the region.

B. GENERAL RECOMMENDATIONS

I. PRIORITY AREAS FOR ACTION IN ASIA

The Conference RECOMMENDS[1] to participating Governments for priority action in Asia:

1. *The promotion of appreciation of science by the common man* through full use of mass communication techniques, functional literacy programmes, science clubs and fairs, co-operation with national and international organizations—both governmental and non-governmental—including women's organizations, and with special emphasis being given to reaching the rural population.

2. *The improvement of science education and the expansion of facilities for it at all levels*, particularly in all schools at the primary and secondary levels, through increasing the number of teachers and raising their qualifications and through parallel and related improvement in curricula, teaching materials and equipment.

3. *The promotion of recruitment and training of middle-level technicians* including *agricultural technicians*, through improving their status, and career prospects, with possibilities for up-grading by means of in-plant training and refereshser courses in institutes, the development and standardization of curricula and laboratory design and the training of technical school teachers.

4. *The development of agricultural education* through the expansion of facilities for it; improving curricula, teaching materials and equipment; ensuring the necessary connexions with extension work; applying a multi-disciplinary approach to both basic and problem-oriented agricultural research programmes.

5. *The development of information and documentation facilities* through strengthening existing centres; establishing new centres and links between national centres; rationalizing existing systems and making maximum use of modern techniques of reproduction, abstracting and data processing; considering the establishment of one or more regional information clearing-houses.

6. *The strengthening and fostering of scientific research and technological development* through collaboration between universities and existing scientific and industrial laboratories, and also through the creation of institutes for advanced studies within the universities of the countries.

7. *The development of the human element of the national scientific and technological potential* through improved training, employment and working conditions for scientific and technical personnel, and equal educational opportunities to all.

8. *The formulation and implementation of a purposeful national science policy* concerning the whole chain of related national activities, in particular integrating education, research, technology and industry and, in doing so, to recognize as a basic option the principle of endogenous development, while ensuring the integration of national science policy with development planning policies at the highest governmental level, and establishing and expanding the research and development base of science policy.

9. *The organization and promotion of international and regional co-operation* particularly in exchange of information and scientific

1. This recommendation is based on the proposal contained in CASTASIA/DR. 6 submitted by the Reporteur-General.

personnel, co operative pooling and use of scarce resources and adoption and transfer of appropriate technology.

PART II

CONCLUSIONS AND RECOMMENDATIONS

B. GENERAL RECOMMENDATIONS

ADDENDUM

II—TARGETS FOR TOTAL NATIONAL EXPENDITURE ON RESEARCH AND DEVELOPMENT

The Conference recommends to participating Governments of Asia to endeavour to reach a minimum level of total national expenditure on research and devolopment of 1% of their gross national product as soon as possible, but not later than 1980, it being understood that the total national expenditure on research and development, comprises current and capital expenditure on research and development, financed by both governmental and private sources.

III— TRANSFER OF TECHNOLOGY

The Conference RECOMMENDS that:

1. Technology transfer and Information Centres be set up urgently with the functions proposed by ACAST and with branches, wherever necessary, in order to provide assistance to enterprises in identifying their technological needs, ascertaining the availability of the necessary technology abroad, and the negotiation of agreements.

2. The Secretary-General of the United Nations be invited to review the overall position of the work done in the field of transfer of technology by different bodies of United Nations and draw up a comprehensive plan and programme of action for operating transfer of technology.

IV.—MECHANISM FOR REGIONAL CO-OPERATION

The Conference,

Desirous to ensure the fullest implementation of its recommendations and

Convinced of the usefulness to this effect of strengthening regional co-operation,

Recommends that the Director-General be invited by the General Conference to study the ways and means of establishing in Asia, under the auspices of UNESCO together with ECAFE and in collaboration with ILO, FAO the Asian Development Bank and other international and regional organizations, as appropriate, a permanent machinery to keep under regular review, stimulate and facilitate the co-operation of the Member States represented at the Conference for the implementation and follow-up of its recommendations and be authorized, subject to the approval of the Executive Board, to take steps for the creation and functioning of such of machinery as soon and as efficiently as possible.

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VIJNAN KARMEE

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Regd. No. D-1650

Printed and Published by Baldev Singh at the United India Press, Link House, B.S. Zafar Marg, New Delhi
Regd. No. A—1468

Vol. XX September 1968 No. 9

VIJNAN KARMEE

Journal of the Association of
SCIENTIFIC WORKERS OF INDIA

Annual Subscription Individual Rs. 10.00
Institution Rs. 25.00

Single Copy Re. 1.00

Editorial Office :
P. Box No. 137,
New Delhi-1

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EDITORIAL

Migration of Scientific & Technical Personnel

The award of Nobel Prize to Indian born Dr. H.G. Khorana has rekindled the controversy on what is variously called 'brain drain' or the 'flight of scientific talent'. The Parliament, the press and the public opinion has been exercised over the fact that when Dr. Khorana returned from abroad after completing his advanced studies under Lord Todd, the Head of the Department of Chemistry, Delhi University failed to offer him even a teaching post. The ICAR could not get his selection through the UPSC and the then Director General, CSIR, also failed to provide for him in the CSIR. Thus, Dr. Khorana had no other go but to migrate first to Canada and then to USA. It is argued at the highest level that in retrospect it was good for world science that Dr. Khorana was not able to find a job in India because he could benefit from the facilities available in advanced countries and win the covetted award. Had he stayed on in India, his talent would have been lost to the world ! It would be self-deluding hypocricy to dispose off the problem in this manner. It would appear as if we are lamenting the loss of one single brilliant individual. What we should, as a nation, be concerned over is the long range efforts of migration of the cream of scientific and technical personnel from this country to Western Europe and America.

The question of 'brain drain' has been under discussion in India since the last two years. The Khorana episode merely highlighted the criminal neglect on the part of scientific bodies to come to grips with the problem. It appears worthwhile to summarise the arguments as put forward by the two sides in the controversy. On the one hand, are those who argue that every effort should be made to bring back the scientists who have settled or settling abroad. Liberal terms should be offered to tempt them to return by giving concessions of free return fare, assignments in the scientists' pool and super-numerary posts ; that India can ill-afford to lose its scientists to other countries while it may need them for its own industrial and economic advancement. The other side to the controversy points to the fact that 'brian drain' is not an isolated phenomenon relevant to this country alone, that it will be inadvisable to enact legal barriers against the scientists moving freely from one country to another since science is international. The most forceful argument is that India is unable to provide employment even to those that choose to remain in the country. In view of large scale unemployment amongst engineers and scientists it will be adding to their number to invite back those who have migrated abroad and are doing useful work in scientific institutions outside the country.

The sentimental approach of getting Indians back home ignores the hard realities of the Indian situation, while the other argument amounts to a refusal to do anything to change the paradoxical situation where a country going through industrial revolution finds itself surplus in scientific and technical personnel. It is not so much a question of one Khorana as the fact that at least 60-80%of the first class B.E.s and M.E.s in fields such as

electronics, metallurgy, engineering, physics are migrating from India with scholarships privately obtained by correspondence with universities and institutions in Canada, West Germany, USA etc. leaving mediocre and second grade talent behind. The cream of Indian talent thus provides the second rank assistantship in the research and teaching institutions and industrial organisations in the advanced countries, while the mediocrity and second rate talent add to the frustrating situation in the country. The issue cannot be resolved by debating within the restricted field of finding employment in scientific research institutions and universities. The basic question is as to why these people are unemployed and what should be their field of fruitful absorption within the country. The issue is linked with the need for a basic change in the policies concerned with industrial development and administrative management. Unless the present trend of industrial development through import of second and third rate technology through technically incompetent or ignorant channels is given up forthwith and unless the country is put to the challenging task of developing its industrial competence with the maximum of national effort, there is no remedy to the migration of the cream of technical talent. The present management of the country is deeply seeped in the traditions and administrative structure left to us by the British. It is completely unsuited to the process of industrial advancement. Since the entire administrative structure is built on a negative approach of checks and balances, it cannot create conditions where the industrial and scientific policies freely contribute to economic and industrial advancement. Unless the administrative management and industrial policies are drastically recast, the policies in regard to scientific and technical personnel cannot be given correct shape. The root of the matter goes back to the need for a revolution in our administrative and industrial policies. That is where the first change must come about. While temporary measures should be there as palliatives to soften the hardships of the scientific and engineering community, and every effort should be made to get back those scientists who can contribute to scientific and industrial progress, it would be futile to advocate the return of talent unless the country pulsates with the spirit of challenge. We have no doubt that our scientists abroad will respond to the call of motherland provided the industrial and scientific atmosphere in the country is such that they can make an effective contribution on return. As at present, there would be no point in asking our bright youngmen to go wandering in the corridors of the governmental offices and research institutions, looking for crumbs of favour from administrative and scientific bureaucracy, forfeit their dignity by standing outside the doors of the bureaucrats filling innumerable application forms and appearing before put-up selection committees. In such a situation it will be better to leave them to seek their fortunes elsewhere.

As scientists it is our duty to warn the governmental authorities and the scientific community of the danger to the future development of the country represented in the loss of the brightest of the younger scientists. The present policy of 'do nothing and complacency' would be disastrous and we would be guilty of crime against the coming generations to let the situation drift. The Committee on Science & Technology should deliberate this issue as a first priority and call upon the government to undertake a thorough overhaul of the administrative management and industrial policy to bring there in line with the requirements of speedy industrial, economic and scientific growth.

Frankly Speaking

SCIENTISTS AND THE 'P' FORM

We have with us a copy of the letter of Prof. G. K. Manna, D.Phil., D.Sc., P.R.S., F.N.A.Sc., Head of the Department of Zoology and Dean, Faculty of Science, Kalyani University addressed to the Prime Minister and other authorities. Dr. Manna is the President of the Zoology Section of the forthcoming 56th Session of the Indian Science Congress being held in Bombay and is a recognised international authority in the field of genetics. He was invited by the Organising Committee of the 12th International Congress of Genetics of Japan to serve as Chairman of the Section of Cytogenetics. He was offered expenses for his stay in Tokyo. He had another invitation to deliver a lecture at the Symposium on Human Chromosomes at the Hokkaido University organised by the Society of Chromosome Research. His hotel accommodation and round-trip air passage from Tokyo to Sapporo was arranged. The Kalyani University made Dr. Manna a delegate to the 12th International Congress of Genetics and offered a round trip passage from Calcutta to Tokyo. The learned Doctor booked his passage and sent his consent to the Organisers of the Conference to serve as Chairman and conveyed to the Symposium Committee the title of his talk. But then came the 'P' problem !

After patiently waiting for about a month, Dr. Manna was informed that the Reserve Bank of India could not agree to the grant of 'P' Form since it involved a minor expenditure of foreign exchange even though the fare to Air India was to be paid in rupees. It would not have amounted to much but it was made an argument for humiliating an Indian scientist before an International Conference. Dr. Manna writes : "The honour bestowed upon me was the honour to my country which I could not keep. Moreover, I was forced by the circumstances to behave as an utter irresponsible person for not informing the Organisers of my inability to attend the conference because the Reserve Bank gave the information on the day when the Congress session had already started." For the same congress foreign exchange was sanctioned to another person as also foreign exchange for a post-congress study tour. Dr. Manna wonders if there is any system or criteria for decision in these matters !

The entire approach in regard to attending seminars, symposia and congresses abroad reeks with favouritism. Those on the right side of authority get all the trips while others who either have no pull or choose not to exercise the channels of influence, have to face embarrassments and humiliations as in the present case. We feel that the decision as to who should attend which conference should be left to the discretion of the scientific societies and organisations of scientists and should not be in the purview of administrative authorities. If necessary the resources to be made available for attending international congresses could be indicated. The scientific societies could be sounded about these conferences sufficiently in advance and asked

(Continued on p. 15)

Policy on Scientific Personnel

M. G. KRISHNA *

It is widely accepted that the main objective of CSIR is to actively assist in the economic and social development of the country by the application of science. This was intended to be achieved by development of process, products, equipment designs and fabrication techniques to promote industrial growth and by development of methods for economic utilisation of internal resources and for reduction of waste. The emphasis has always been on the applied aspect of the work, with provision to undertake researches on such topics of fundamental scientific research that would flow out of technological work. Researches on subjects of curiosity and of long-range applicability were mostly left to universities and other teaching institutions. The National Laboratories and institutes of CSIR reflect this objective by their coverage of various disciplines and industrial sectors whose problems, including standardisation and quality control, have been under their study.

The policy on personnel, equipment and working facilities and management should therefore be such as to promote R & D work in all the CSIR laboratories with a view to achieve the main objective.

Personnel policy covers the following aspects :

(i) Recruitment

(ii) Incentives

(iii) Career development and job satisfaction.

A review of the personnel policy would be inadequate and incomplete, if all the three aspects are not considered in an integrated manner.

A. Present situation

Recruitment

Procedures and Rules

The present procedures and rules regulating recruitment of personnel are clearly out of date and require substantial modification for the following reasons :

1. The time taken on recruitment is extremely long and has often led to frustration among the applicants.

2. The procedures are very unrealistic and unsuitable for recruitment of scientific personnel. There is no provision for quick recruitment of persons with bright careers and with specialised experience as and when available or needed by a laboratory.

3. The present method of budgeting and sanctioning posts is time-consuming and unsatisfactory. Due to the uncertainty every year, long-term planning of programme cannot be done satisfactorily.

*Director, Indian Institute of Petroleum, Dehra Dun

Qualifications and experience of candidates

An important aspect of the recruitment policy concerns the qualifications and experience of candidates to be recruited. Frequent criticism has been made in recent years of the recruitments made in CSIR laboratories and much of it is based on serious misconceptions on the method of judging the merit and potential capability of a candidate. Many specialists of the older generation, who sit on selection committees, carry a rigid and unrealistic view of the qualification required for a job. This is particularly true in certain engineering disciplines and inter-disciplinary areas. For example, in the field of engineering, the bachelor degree courses of most universities cover substantial parts of the fundamental principles underlying engineering study so that a bachelor can successfully start research work under guidance from a senior. On the other hand, a bachelor in science (B.Sc.) does not work; have adequate grounding to start research he needs a master's degree. To generalise and insist on post-graduate qualification as a minimum requirement for growth in a research career is damaging, particularly to the engineers who have acquired some research experience.

Also, under the economic and social conditions prevailing in India, a student may not be able to pursue continuous higher studies leading to doctorate degree, despite his intelligence and capabilities. Several such persons often develop into capable researchers and their experience has to be given due consideration in selections and promotions. One such example, is the late Dr.B.V. Nath, former Director, Indian Agricultural Research Institute, New Delhi (Appendix 1).

There are reputed Indian scientists who have started their teaching, research and other professional careers and became professors during 1920s and 1930s with a master's degree and not a doctorate degree, which will be considered a minimum in pure sciences today. Some illustrious scientists, who have proved to be outstanding teachers and researchers, are prof. S.N.Bose, F.R.S., Dr. S. Bhagvantam, and Prof. D.N. Wadia (Appendix 2).

Subject of Study

Sometimes the subject that one has taken in the degree course may not be in conformity with his professional career and accomplishments. This is particularly true in border disciplines and inter-disciplinary fields (such as bio-chemistry) and in subjects where specialized degree courses have been started only in recent years. In such cases, applicants suffer at the hands of conservative members of selection committees or because they do not strictly satisfy the letter of the advertisement. If such applicants are selected, they are considered as cases of irregular appointment in fact, is not so.

In the Western scientific scene, there are many cases which prove that outstanding success in research can be achieved even when the subject of specialization in the degree course is apparently quite unconnected with the field of professional success. On the other hand, the fact that this is entirely feasible will be understood if it is realised that fundamental principles of physics, chemistry, biology and mathematics are the foundation of applied sciences and that what matters is the capability of a researcher to apply principles and to boldly cross conventional frontiers. Some well-known examples of this type are :—

Late Prof. J.B.S. Haldane, who had degree in mathematics and specialised in biology and biometry (Appendix 3.1).

Prof. M.W. Thring, who had a M. A. degree in Physics and was professor in Fuel Technology and Mechanical Engineering (Appendix 3·2)

Prof. George Von Bekesy who had a Ph.D. in Physics and won Nobel Prize for 1961 in Medicine and Physiology (Appendix 3.2).

The case of Louis Pasteur who, being a chemist, was denounced for his work on immunology by the then medical experts in France, is a well-known example.

In India, even now, many older experts who often sit on selection committees ask questions such as : "You are an organic chemist ; how can you specialise in biochemistry?", or, "how are you connected with medicine ?" It would not be surprising if Dr. H. Khorana, the recent Nobel Prize Winner, has passed through such a situation in India. Unfortunately, a type of "caste system" has become entrenched in the conventional criteria applied by some of the selectors.

It is therefore more important to judge the total career and overall capability of an applicant than merely his academic qualifications. The foregoing examples show that successful careers in R&D work can be created provided the selectors have the vision to spot the available talent, adopt a liberal attitude and provide opportunities for work.

In this context, the case of Prof. R. B. Woodward, for whom a special curriculum was designed for the first time at the Massachusetts Institute of Technology (U.S.A.) and who later won Nobel Prize in Chemistry for 1960, is very revealing. Existing rules and methods had been changed to provide an opportunity for a single person (Appendix 4). In India too, such vision, understanding and liberalism were applied by Sir Asutosh Mukherjee, who "could recognize merits even among untried people", when he appointed young fresh M.A.s (M.N. Saha, S.N. Bose, J.C. Ghosh, S.K. Mitra and others) as lecturers in pure sciences and made a "very discriminating choice" of C.V. Raman for Palit Professorship in Physics at the University College of Science, Calcutta. In the presentday context an equally deep understanding and vision are required to provide opportunities to young minds for development work in many applied fields.

The foregoing examples idicate the following :—

1. research workers often tend to migrate from field to field, depending upon their interest and ability ;

2- it is therefore undesirable to rigidly stipulate subjects of specialisation as basis for recruitment, only broad indication of areas of study and specialization is desirable ;

3. Selection Committees should look at problem of recruitment with vision and understanding and should have the freedom to deviate from conventional criteria to select promising candidates.

Incentives

They can be broadly classified as :

—Pay scales.

—Royalties and other benefits.

—Promotions.

Pay Scales

The present CSIR pay scales for scientific and technical posts have the following features :—

1. The higher scales are satisfactory compared to those prevailing in other Government departments but there are too many steps.

2. The lower scales are unsatisfactory, far too numerous and many of them overlapping.

3. Some of the designations have led to too much hierarchy and deserve to be abolished.

It is necessary to reduce the number of designations and simplify the hierarchy.

B. Royalties and other benefits

Payment of Royalties—the principles

The objects in the Memorandum of CSIR Association quoted in the second term of reference contains the following important clauses : "royalties arising out of the development of the results of researches to those who are consideted as having contributed to the pursuit of such researches." This clause has two operative parts.

1. '*Arising out of development of results of researches.*'

It is often not adequately realised that a laboratory scale research result, however exciting or important, will not by itself produce financial returns ; it may lead to a patent and publication and scientific credit. The results have to be 'developed' to industrial scale of production so as to yield returns in the form of lump-sum or recurring royalties. The whole effort is therefore often called 'Research and Development' work.

The distinct teams often participate in the two phases of work with due collaboration; the research team and the development team.

In order to protect the process, the patent is always filed in the names of the main research workers, as soon as research result is considered significant, but very much before any development is considered necessary. In fact, many patents do not get developed to commercial production and therefore, remain unremunerative.

In the CSIR Laboratories, there have been some misunderstandings due to the fact that laboratory research team on whose name the patent is filed tends to claim the whole share of the royalty allotted to the workers whereas the major effort in manhours and solution of problems of design is often bestowed by the development team whose names, naturally, do not appear on the authorship of the patent.

2. "*Those who are considered as having contributed to the pursuit of such researches.*"

This second operative part can be misleading because the term 'researches' is used and not 'development'. In international practice, research and development are two distinct, though closely inter-related phases of work. Strictly speaking, the team 'contributing to the pursuit of researches' is different (at least partly) from the team contributing to the development of results of researches'.

It would be grossly unfair if the royalties arising out of development of results of research are paid mostly to those contributing to 'pursuit of research'. On the other hand, the original credit for discovery of a process or product belongs to the team that conducted the research. A balance has to be struck in the distribution of royalties to do justice to research and development teams.

It is, therefore, necessary, to avoid possible complications, to reword the clause to read "...to those who are considered as having contributed to the research and development effort".

Distribution of Royalties

Presently, there is no fixed proportion in which royalty is to be distributed to the individual participants of the research and development work, although overall ratios have been fixed for distribution among NRDC, CSIR and the laboratory. It is desirable to fix criteria for distribution of royalty among individuals taking into account the man-hours spent, input of originality and intelligence and the complexity of the work. For example, if the main discovery is itself a simple process but requires a complicated reactor or other equipment to make it workable on a commercial scale, a larger proportion may be given to the development team. If the discovery involves a new route or brilliant idea the research team may be given a higher share.

Also, it must be made a standing principle that intellectual work requiring originality and initiative should be credited with a higher share than routine assistance, however laborious the latter might be.

It is desirable to study international practices in this regard and evolve a system suitable to Indian conditions.

Other Benefits

Apart from royalties for processes and products sold to industry, other fees are also earned by laboratories for consultancy and short term work. Whenever fee is earned on a substantial investigatory or design work, it would be desirable to distribute a part of it to the concerned workers. Such distribution is not desirable on routine work and on such jobs which the laboratory is normally expected to do.

C. Promotion

Promotion to higher scale of pay and higher responsibility is an important incentive in a career. As at present, every post has to be created and advertised and all departmental candidates have to compete with outside candidates in every interview. This is very frustrating to many good research workers. There is no provision for internal promotion of departmental candidates. The present system has created many misunderstandings in outside candidates who seem to think that all advertisements are a farce, intended only to present an 'eye-wash' to the public. Generally, departmental candidates, being trained on specialised jobs, prove better than many external candidates who are not used to the job requirements. Even when such good candidates are selected in interviews, favouritism is alleged. It has become almost a sin to be efficient and good in public service. Unless this situation is soon remedied by providing for departmental promotion after scrutiny by appropriate committees, the frustration will deepen. Such provision should be made at all levels upto and including Scientist E.

The present method of granting merit increments is very limited and also time-consuming. A reward will prove an incentive to a person only when it is timely and adequate. Under the present system, the only incentive is promotion to a higher post whose number is very limited. The annual increment, which is automatically earned by a shirker as well as an industrious person, is taken as a right and not as an incentive. A person who does a particularly good work expects an extra incentive. It is, therefore, most desirable to provide for more liberal granting of *ad hoc*

increments, at two or three yearly intervals, which would encourage those who cannot be promoted to a higher responsibility.

Scientists, acquiring high level of expertise in their fields should be offered special salaries even more than the Director.

D. Career development and job satisfaction

1. An important aspect of career development concerns the acquisition of new knowledge, experience and capabilities during the service. This is achieved not only by on-the-job experience but also by receiving specialized training at regular intervals. The possibilities of receiving such training in India have been much reduced by unrealistic rules. For example, there is a rule prohibiting deputation of an employee to a training course which ends in the award of a diploma, just because a diploma course is considered a 'study' and not 'training'. In one instance, a candidate had to be recalled from an Applied Optics training course at I.I.T., New Delhi, on this ground.

In the modern scientific age, when new specialized techniques are rapidly being developed, the present restriction is utterly outdated and objectionable and should be removed. Permission should be liberally given for employees being deputed to short-term (maximum one year) training courses in specialized techniques and subjects which are of direct benefit to the sponsoring organization.

2. One of the ways of achieving job satisfaction is to see that the work is used and appreciated by a customer, particularly industry. It is therefore necessary that employees in C.S.I.R. Laboratories have ample opportunities to visit industries connected with their work as frequently as required. The present budgetary grants are very meagre for this purpose. More liberal grants should be available for industrial visits and training so that researchers get a practical outlook and do an efficient job.

E. Suggestions for improvement

Recruitment

Standing specialist committees or panels should be formed for each laboratory to facilitate quick interviews and selections. It should not be necessary for Laboratories to obtain approvals of selection committees each time from the CSIR Central Office.

2. The Directors of Laboratories should be permitted to recruit promising scientists on *ad hoc* basis upto the pay scale 1300-1600 (Scientist E) or on fixed salary slabs, in consultation with the Director-General who should be empowered for this purpose and should use these powers liberally. Safeguards may be provided as necessary and limits may be kept on the number of such *ad-hoc* recruitments per year. Guiding principles may be laid down for *ad-hoc* appointments.

3. The number of research fellowships granted to each laboratory should be increased.

4. Recruitment to all posts upto and including Scientist 'C' should be done directly by the Laboratories.

Incentives :

Pay-scales

(1) *Research Scientists* : There should be only limited Scientist levels after Director. Pay scales should be longer (*e.g.* 500-750-1300 ; 1300-2000, with provision to recruit at 500 or 750 stage).

(2) *Assistants* : There should be one category of assistants with the designation 'Research Assistant', carrying a pay scale 250-600, with provision to fix salaries according to merit.

(3) *Technicians* : All the rest of the technical staff should be designated as Technicians, with a limited number of grades (*e. g.* A, B, C, D) carrying different pay scales, (*e.g.* 100-150, 150-250, 250-350, 350-600)

Promotions and merit increments

(1) Provision may be made for promotion and grant of merit increments to all the categories of staff by departmental assessment made by suitable standing or review committees.

(2) Grant of upto five merit increments may be permitted by periodical assessment.

(3) In special cases of unexpected discoveries or merited work, out-of-turn promotions and merit increments should be provided for.

Royalties and other benefits

(1) The pattern of distribution of royalties may be decided by specialist committee after considering international practices.

(2) The staff, working on special investigations or designs for outside parties from whom a fee is charged, should be given some share of the fee as decided by the Executive Councils of the Institutes.

Equipment and Working Facilities

Need for up to date equipment

1. A major part of present scientific and technological work requires modern and up-to-date equipments, for obtaining reliable and detailed data in a relatively short time. About two decades ago, it was possible to take more time to obtain results ; presently, the industrial projects and import or export requirements are so demanding on time that results cannot be obtained merely by laborious manual methods. Also, many modern technological processes which India is importing are based on accurate compositions and close tolerances of impurities. The CSIR Laboratories which are closely connected with industry (such as, the Indian Institute of Petroleum, Dehra Dun), are often called upon to undertake work to supply accurate data which can be relied upon by foreign process licensors. All such work requires the use of modern instruments and equipments.

Likewise, for present day technological work, it is essential to use specialized equipments, many of which can be costly.

2. Having made it a national policy to undertake indigenous studies leading to import substitution and process and product development, it becomes obligatory on the part of the CSIR Laboratories to provide adequate funds to obtain specialized equipments and instruments essential for work. It would be very unwise to grudge funds for this purpose. Obviously, every effort should be made to avoid extravagance and waste. The needs should, however, be judged from the viewpoints of present day technological and scientific requirements and not of outdated and misplaced concepts such as, 'we should use simple equipment' or 'many great discoveries were made without sophisticated instruments' and the like.

3. Another aspect of the problem concerns the way budget grants are made for purchase of equipments. It is necessary that the need

of each CSIR Laboratory should be judged on the basis of the tasks that it has to shoulder and the type of work done. There cannot be one standard yardstick to apply uniformly to all laboratories, such as fixed ranges of grants or percentage basis. Such an approach is damaging to the effective functioning of the laboratories.

4. Working facilities

It has often been publicly commented that unsatisfactory working environment is responsible for poor output of CSIR Laboratories and also for many bright young scientists trying to settle abroad. Working facilities constitute one aspect of the working environment. If the facilities are poor, a scientist who is exposed to and trained with modern concepts and techniques becomes quickly frustrated.

It must be admitted that often proper working facilities cannot be provided in time because of outdated rules and procedures which have never imagined the need for the type of work presently undertaken by the laboratories. Rigid interpretation of rules has often resulted in annoying waste of time or inability to progress. Examples of this type vary from simple amenities to specialized needs. For example :

Provision of protective winter dresses to staff working on pilot plant or outdoor jobs in cold regions. (The rule provides for dresses or liveries only to certain categories of staff).

Air-conditioning of rooms having specialized equipments. (In India, most administrators and accountants think that air-conditioners are needed only for comfort of very senior officers and do not realise that many modern instruments function best or only in conditioned environments. Often, purchase of equipment is permitted but not the air-conditioner.)

Special safety provisions for work and regular check-up of personnel working under hazardous conditions.

Prolonged procedures for purchase of equipments and instruments-even those indigenously available.

Remedial measures are necessary to remove outdated rules and procedures which are more applicable to administrative offices than to research laboratories and to introduce more realistic and job-oriented procedures.

APPENDIX 1

DR. B.V. NATH

Born : 1st January, 1889

Died : 1st February, 1964

Qualifications

Matriculate

Had no University Education

Elected F.R.I.C., 1924

Awarded Hon. D. Sc. by Annamalai University in 1943.

Career

1912 : Chemical Assistant in Department of Agriculture, Madras.

1923 : Agricultural Chemist, Govt. of Madras.

1934 : Imperial Agricultural Chemist at the Imperial (now Indian) Agricultural Research Institute, Pusa, New Delhi.

1935-44 : Director, I.A.R.I., Pusa (First Indian Director).

1944-47 : Director of Agriculture, Madras.

1948-49 : Irwin Professor of Agriculture and Principal, College of Agriculture, Banaras Hindu University.

Short periods :

Director of Agriculture and Regional Food Commissioner, Rajasthan.
Agricultural Adviser to the Planning Commission.
Director, Eastern Technological Laboratories.

"Matriculating at the age of fourteen, he found himself deeply interested in the small scale industries and the same year he went to Japan–a country known for development of small scale industries. On his return after a year, his ambition was further kindled by his close association for about a year with Acharya Prafulla Chandra Ray in Calcutta. He established a laboratory for the assay of ores and minerals and made himself known as a first class analyst.

His reputation as an analyst was so high that he was appointed in 1912 as Chemical Assistant in the Department of Agriculture, Madras, notwithstanding the fact that the basic requirement for such a post was a university degree.....

Dr. Viswa Nath had no University education, but he had the credit of training a large number of students for higher research degrees of the Universities and publishing many scientific papers in the domain of soil science and agricultural chemistry. During his service of 44 years, several honours were bestowed on him by the Government and Universities and various scientific bodies in India and outside".

(Journal of the Indian Society of Soil Science, Vol. 12, June 1964, No. 2, p. 73-74).

APPENDIX 2

(1) PROF. S.N. BOSE

Born : 1st January, 1894

Qualifications

Inter Science, 1st rank in the University
1913 : B. Sc. (Hons.), 1st rank
1915 : M. Sc. (Mixed Mathematics) 1st rank
1957 : Hon. D. Sc. of Calcutta University
1958 : F.R.S., London

Career

1915-20 : Lecturer, Physics Department, Calcutta University.
1921-24 : Reader in Physics.
1924-27 : Work in Europe.
1927-45 : Professor, Dacca University.
1945-56 : Professor, Calcutta University.
1956 : Emeritus Professor.

(2) PROF. S. BHAGAVANTAM

Born : October 14, 1909

Qualifications

B. Sc. (Madras)
M. Sc. (Hons.) (Madras)
1940 : Hon. D. Sc. Andhra University.

Career

1932 : Reader in Physics, Andhra University.

1938 : Professor in Physics and Head of Department, Andhra University.

1942-48 : Principal, College of Science.

1948-49 : Scientific Adviser, Indian High Commission, U.K.

1949-52 : Professor of Physics and Director, Physical Research Laboratories, Osmania University.

1952-57 : Vice-Chancellor, Osmania University.

1957-61 : Director, Indian Instt. of Science, Bangalore

1961 : Scientific Adviser, Ministry of Defence.

(3) DR. D. N. WADIA

Born : 23rd October, 1883

Qualifications

1907 : M.A.
D. Sc.

1957 : Elected F.R.S.

Career

1907-21* : Lecturer and later Professor in Geology, Prince of Wales College, Jammu.

1921-38 : Geological Survey of India.

1938 : Government Mineralogist in Ceylon.

Other subsequent assignments

Geological Adviser to Government of India.

Director, Indian Bureau of Mines.

Head, Atomic Minerals Division, Atomic Energy Commission.

1963 : National Professor in Geology Awarded Lyell Medal of the Geological Society of London.

(Dr. D. N. Wadia Commemorative Volume, Mining, Geological and Metallurgical Institute of India, 1965, p. 1).

* "In those days, however, geology was taught only in Calcutta and Madras, and so Wadia was largely self-taught as a geologist. Nevertheless, in 1907 he was appointed to teach geology in the Prince of Wales College, Jammu, a post which held until 1921 when he was appointed to the Geological Survey of India at the relatively advanced age of 38."

APPENDIX 3

(1) PROF. J.B.S. HALDANE, F.R.S.

Born : 1892

Died : December 1, 1964

1914 : I Class Hons. in Maths. and Literaire Humaniores at Oxford.

1919 : Fellow of New College, Oxford.

1922-1932 : Reader in Biometry at Cambridge ; partly, Professor of Physiology at Royal Instt., London.

1932 : F.R.S.

1933 : Professor of Genetics at London—Chair created for him.

1937-1957 : Professor of Biometry at London Shifted to India 1957.

Awards :

1. Darwin Medal of Royal Soc. 1933.
2. Linnean Society's Darwin-Wallace Commemoration Medal—1958.
3. Kimber Medal of U.S. National Academy of Sciences—1961.

4. Pontifical Academy of Sciences (1961—Award £ 11,500 for Biology)

Ref. JSIR (General)—(Vol. 23, 1964, p. 501)

(2) PROF. M. W. THRING

Qualifications : M. A. (Cantab)—Maths. & Physics.

Career

1937-46 : BCURA : Aerodynamics of domestic fires, etc.

1944 : Head, Combustion Lab. (down jet system of combustion).

1946-53 : Head, Physics Deptt., Brit. Iron & Steel Res. Inst.

1953-64 : Professor of Fuel Technology and Chemical Engineering at Sheffield University (Turbulent Jet diffusion flames, radiant heat, physics and chemistry of combustion of flames).

Oct.

1964 : Prof., Mech. Engg., University of London.

1964 : Awarded Sc. D. of Cambridge University.

(Ref. J. Inst. Fuel, Vol. 35, 1962 p. 421).

(3) GEORGE VON BEKESY

Born : Budapest June 3, 1899.

Awarded Nobel Prize for 1961 in Medicine/Physiology "for his discoveries concerning physical mechanism of stimulation within the cochlea".

Studied Chemistry at University of Berne.

1923 : Ph.D. in Physics—Budapest.

Till

1946 : Worked in Hungarian Post Office, Budapest, worked on long distance telephone transmission; spent considerable time here in the study of the ear as the main component of the transmission system.

1939-44 : Professor of Experimental Physics. Left in 1946 for Stockholm and developed a new type of audiometer that can be operated by a patient.

1947 : Went to USA and started work at Harvard University, in the Psycho-acoustics Laboratory. Later, interested in developing a mechanical model of the inner ear with nerve supply, the latter being represented by the skin of the arm. This model shows so close similarity to the phenomenon of hearing that it has become a useful tool in investigation of some specific problems on the subject. Developed an elaborate technique for the purpose of recording events in the transmission system of the ear—it is worthy of a genius. Made fundamental discoveries on the dynamics of the inner ear.

(Ref. Nobel Prize Lecturers—Medicine or Physiology)

APPENDIX 4

PROF. R. B. WOODWARD

Donner Professor of Science, Harvard.

Nobel Prize in Chemistry for 1965 for perfecting the 'Art of Organic Synthesis'.

Synthesised Chlorophyll in 1960. Quinine in 1944, strychnine in 1947.

"When Woodward entered MIT as a freshman (age 16 years) he had already as much knowledge of organic chemistry as a man normally acquires during four years of enrolment in undergraduate classes. In spite of this, Woodward flunked out of MIT in the middle of his 2nd year.

"At that point, the slow (to him) pace of prescribed chemistry curriculum created a restlessness and boredom that nearly proved disastrous to his career. Fortunately as advocates of progressive education would claim, the MIT faculty grasped the situation and designed a curriculum for Woodward's exclusive use. Its flexibility enabled him to experiment in his own laboratories and spend as little time as he wished in classes, provided he presented himself for exams..."

In 1936, at the end of 3rd year MIT awarded him B.S. degree ; at 20 years he had his Ph.D. (1937).

" We saw we had a person with a very unusual mind and we wanted to let it function at its best. If the red tape necessary for the less brilliant mind had to be cut, we let it go. We did for Woodward what we have done for no other student like him in our dept."

(Ref. Chem. Eng. News, May 22, 1967, p. 67).

(Continued from p. 3)

for their recommendations. So far as the administrative authorities and Reserve Bank are concerned, they should only process the recommendations and should not sit on judgement on the merits of the scientists. The scientific community itself is to blame for not organising its opinion and not functioning with sufficient responsibility. If the scientific community through its accredited bodies takes greater interest in planning the nominations to scientific conferences and presents a united opinion on what should be done, we have no doubt that a solution out of these embarrassing situations could be found.

Role of Class IV Staff in laboratories and improvement in their service conditions

Kshirod Ranjan Bhattacharya*

A large number of Class IV staff are employed in all laboratories in various capacities, whose service conditions leave much to be desired. An analysis of the situation and lines of remedy are presented here.

Role of Class IV staff in laboratories

There appears to exist a lot of misconception on this point. Lectures are often given from high quarters that it is undesirable to employ many, if at all, of these personnel; that they are nothing but luxuries or status symbols; that they are already excessive in number; that we should learn 'dignity of labour' and so on. Presumably following this logic, the axe is invariably brought down on these staff whenever an occasion of 'economy' arises such as in a 'national emergency'. (Of course there is more to it. Whenever a directive of 'economy' comes, discretion demands a symbolic act of compliance. These people then come handy, for they are the least likely to raise a hue and cry.) It is probably for this feeling again that the local authorities hesitate, lest the high gods be offended, to create more Class IV posts even when they are badly needed and even when a large number have been working in this capacity on daily wages for prolonged periods, as we shall presently see. It is therefore necessary to state clearly the role of class IV employees in research laboratories and to refute the perverse propaganda that they are either not needed or are already in excess of requirement.

*CFTRI, Mysore

A minimum strength of helpers in a laboratory is essential for carrying out the routine jobs of cleaning and arranging the laboratory, washing of glassware, arranging and looking after minor equipments, and so on. This is recognised the world over. In addition to this, other help becomes necessary in our laboratories. In technological institutes, bulk quantities of materials are constantly needed to be lifted, transported, and processed. Raw materials need to be cleaned and sorted. Equipments and parts need to be carried and assembled. Countries that cannot afford mechanical gadgets for carrying out these jobs must resort to manpower. And herein arises the need for additional Class IV staff. Any comparison with practices in 'America or Japan' therefore is meaningless. Nor is the question of 'dignity of labour' any more relevant, for it is a simple question of the best utilisation of ability and training.†

Class IV staff on 'Daily Paid' Roll

Far from the Class IV strength in the laboratories being excessive, the staff in actual pay roll is invariably less than required. This is testified by the large number of these staff working on daily wages invariably found in all laboratories at any time. Inquiry will reveal that many of the others

†All this of course relates to Class IV staff employed in the laboratories proper and not to 'peons' attached to the administrative sections. We have no knowledge whether these latter staff are in excess of requirement or what is their precise job.

who are regularly employed at the moment have also had to pass through the mill of daily wages for up to several years before being so absorbed.

In fact this has become a regular and unholy tradition with no qualms on any side and with no apologies offered. Few can aspire to be absorbed in the Class IV strength of the garden, the watch and ward and the workshop without initially being employed on daily wages ; the same is partly true of the laboratories proper.

And it must be understood that such employment is not on some odd job for a brief period. Often the jobs are routine, precisely the same as done by any other regular employee. Yet the daily paid tenure goes on up to several years at a stretch. Of course the authorities display great ingenuity in not issuing a sanction for more than a few months at a time and in ensuring brief 'breaks' so that the man cannot have a 'legal' claim. Care is also taken to show the man against a variety of odd jobs in succession or against some production work, but a little inquiry will show their falsity.

As an illustration, the number of Class IV staff, including those on daily wages, in one CSIR laboratory is shown in Table I.

TABLE I

Class IV Staff in CFTRI, Mysore Including Those on Daily Wages as in OCT. 1968 (approximate)

No. in regular posts		No. and period on daily wages			
		Nature of work	0–4.9	5–9.9	10 yrs. and more
Lab. Operator & equivalent	22	Lab. work	15	3	—
Lab. Bearer (Sk.)	37	Production	7	3	8
Lab. Bearer (Unsk.)	34	Workshop	5	2	2
Khalasi	17	Watchman	4	—	1
Peon	12	Electrical Section	7	—	—
Watchman	22	Total	57		
Mali	21				
Sweepers	18	(excluding several others in Civil Engineering Section)			
Total	183				

It is worth reflecting on the human side a little. The man is off on Sundays and holidays and gets no pay. In festival time, when others rejoice, he mourns for he is without pay. The administration and accounts sections deal with his papers and pay bills most tardily, for after all he is just a daily-paid Class IV. His wages are pathetic. As cost structure changes, pay scales are revised, DA is increased. But to increase his wages by 25 paise after 5 years involves a long higgle-haggle with that protector of Public Money—the Accounts Officer. And this goes on for years before someone picks up a little courage to fix a post for him.

Recruitment and promotion

The situation is no better with respect to rules for recruitment and promotion. The same monster of advertisement and selection stalks here as with other categories of personnel. Even after 6 years employment on daily wages in a given job, a man has to apply for and be selected against an advertisement for being regularly absorbed in that job. The laboratory does not usually mind selecting him, but positively detests not putting up a show of fair selection of the best in the world. Interestingly the advertisement (for say a post of Lab. Bearer, *unskilled*) usually specifies experience and *skill* in such and such operation for so many years (all with kind intention—to ensure the selection of the very person).

The same story is repeated later in every step of his promotion, that is if he ever gets one. Advertisement, interview, selection—fair selection of the best at all times ! It speaks volumes about the scientific attitude, courage and conviction of the leaders of our science that such sham and humbug can go on for decades without anybody feeling red in the face.

Grades and Salaries

A description of the grades and scales of pay of these personnel is given below. Knowing the social and economic background of the country, there is little that one can say about these pitiable grades and scales. Yet a few points should be noted.

Grades	Pay scale
1. Laboratory Bearer (Unskilled) (Also Khalasi, Mali, Watchman, Peon, Sweeper)	70-1-80-EB-1-85
2. Laboratory Bearer (Skilled)	75-1-85-EB-2-95
3. Laboratory Operator (also Workshop Operator, Stores-Operator, Laboratory Attendant)	80-1-85-2-95-EB-3-110

1. The first grade is for "unskilled", the next for "skilled". The intention is clear enough to us mortals, but apparently not so to the great leaders of science in India. As it happens, considerable skill and experience are required even for admission to the "unskilled" post. Then one has to spend five, ten, fifteen years in that category before he is blessed with a suitable advertisement and eventually the office recognises that he has "skill". Sometimes a "skilled" bearer in say an ICMR scheme in a CSIR laboratory gets an "unskilled" post when he is eventually absorbed in the regular cadre of the laboratory. What happened to his "skill" during the transformation, none except the specially wise would know.

2. Whatever the rationale of the scales in their early stages, providing a little better career opportunity towards the later stages would yield handsome returns. These laboratory jobs are not just file carrying ; they

require considerable skill, ingenuity and devotion. It is hard to expect these qualities for long from one so poorly treated. As it is, satisfactory service is obtained from this class only when they are young; as they get along in age and private responsibilities increase, they take up an attitude of semi-pension with the willing sufferance of their supervisors.

Remedy

The remedial measures will be obvious from the diagnosis.

1. The practice of employing Class IV staff on daily wages for prolonged periods must be forthwith stopped. In no case must there be more than a given number of people on daily wages at a time in an institute, and in no case must a man be kept on daily wages for more than a given period. The answer to this is not ingenious manoeuvres to remain within the rules, but to absorb the persons whenever they are regularly needed. To this end, the perverse propaganda about the luxury of Class IV staff must be given up, for it is this propaganda which prevents many a timid soul from stating a categorical requirement. And the sectional heads and project leaders must develop a little more courage and conviction to demand a Class IV post when it is needed rather than trying to swim with the current.

2. Class IV staff on daily wages can of course be employed for odd jobs or production works. But their wages must be fixed not according to some 1935 GI Rule, but after considering that pay scales and DA have risen many times since then. They must also be paid for Sundays and all holidays whenever they attend work on the preceding and following working days.

3. Once a person has been recruited in this class, his further promotion must be dissociated from advertisement and selection. There should be rules for regular assessment of performance and diligence, and promotion up to the highest position within the cadre should be provided automatically based on such assessment.

4. The pay scales should be suitably modified to provide better career opportunities especially towards the later stages.

(Continued from p. 20)

Seminar on Import Substitution in Petroleum Products, Processes and other know-how

The I.I.P. (Dehra Dun) Branch of ASWI is arranging a Seminar on the above subject sometime in the month of April/May, 1969. The object of the seminar is to exchange ideas and stimulate thoughts to import substitution aspects in the petroleum field. The papers are invited which may be sent to Dr. K. L. Malik, Analytical Physics Section, Indian Institute of Petroleum. P.O. IIP, Mokhampur, Dehra Dun (U.P.). For further particulars please write to Shri T.C. Joshi, Application Division, I.I.P.

ASWI ACTIVITIES

CSIR-Scientific Workers Association

The 21st Annual Council meeting held in April, 1968 had adopted a resolution that steps be taken by the Centre towards the formation of the CSIR Scientific Workers Association (CSIR-SWA) with the ultimate idea of seeking its recognition from the CSIR authorities. The necessity for recognition was stressed by several of the Council delegates, in the absence of which some of the Branches were facing difficulties in carrying on their normal trade union activities.

Accordingly, a draft Constitution & Bye-laws of the CSIR-SWA based on the present constitution of ASWI and its draft revision, was prepared and copies circulated to the Branches, in the first week of September, 1968. The Branches were invited to send their comments along with nomination for the proposed office bearers of the CSIR-SWA.

Comments have been received from some of the Branches. The draft constitutions was approved by the Branches at Durgapur, Dehra Dun, Dhanbad and Karaikudi. The Karaikudi Branch was of the view that the annual subscription of Rs. 10/- for ordinary members should be uniformly the same irrespective of the salary, since variation on salary basis was detrimental to the trade union-activity. The Dehra Dun Branch, on the other hand, has proposed that concessional subscription of Rs. 5/- for ordinary members should be applicable to those drawing salary upto Rs. 500/- and not Rs. 300/- as stipulated in the draft constitution. The Mysore Branch has, however, raised a basic objection to the draft constitution of the CSIR-SWA in that it ought to have been based entirely on the draft revision of the ASWI constitution earlier prepared. This Branch was, therefore, requested to undertake the work of making the necessary changes in the draft constitution of the CSIR-SWA

CSIR-Enquiry Committee

A number of Branches have forwarded memoranda to the CSIR Enquiry Committee. The Centre has prepared a broad-based memorandum which includes the viewpoints of the Branches, besides incorporation of the views expressed from time to time in the Council meetings in the form of resolutions. The copies of the memorandum would be shortly circulated to the Branches.

Science Circle

During the year 1968, six discussion meetings of the Science Circle were held in Delhi on topics of wide scope. On each topic the discussion was initiated by a person seriously engaged in its study and/or execution of the policies as shown below :

Dr. K. Ganapathi	Patents Bill
Sri Hari Bhushan	How to Employ our Engineers
Dr. A.M. Khusro	Scientific Research and Budget
Dr. M.G. Krishna	Research & Industry in India
Dr. B.D. Nag Chaudhuri	Objectives of Scientific Research in Planning
Shri Romesh Thapar	The challenges of Science & Technology to a Developing Society.

(Continued on page 19)

Association of Scientific Workers of India

P.O. Box No. 137,
New Delhi
August 1968

Dear Dr./Shri

As you are aware the finances of the Association have been in a critical stage for some time past. The branches have not been regular in depositing the membership dues and even on the basis of the estimated returns the Centre would only have a share of about Rs. 3,000. Out of this amount the Centre is expected to run the office as also pay a part of the fare of the delegates to the Council meeting. In addition to this the Centre has also been meeting the expenditure on the publication of Vijnan Karmee which has so far been posted free of charge to the members.

The financial situation has further deteriorated to the extent where the Bureau was called upon to take a decision either to stop the publication of the Vijnan Karmee or to price the journal. After a very serious consideration the Bureau of the Association has decided that a concessional charge of Rs. 5/- may be made to those members who may like to regularly subscribe to VK. The annual subscrip. tion for non-members would be Rs. 10/- and for institutions Rs. 25/-. It was also decided to diversify the contents of the journal and broaden its scope so that it may have popular appeal and it may be possible to get a larger number of advertisements as also a wider circulation amongst the non-members and institutions.

I hope you will appreciate that VK has come to occupy a place in the scientific journals in the country and has evoked very favourable response from a large section of the reading scientific people. If viewpoint of the scientific workers and the problems faced by them as also by science as such in the country are to be brought to the notice of the people and the authorities, it is essential that VK not only survives but gains wider support and circulation. I hope this decision will have your whole-hearted concurrence and you will find your way to contribute Rs. 5/- as your subscription at concessional rate for members only.

Looking forward to your cooperation.

Yours sincerely,

Y. R. Chadha

(Y. R. Chadha)
General Secretary (Orgn.)

Regd. No. D-1650

Printed and Published by Baldev Singh at Narendra Printing Press, 20 Model Basti, New Delhi-5
Regd. No. A—1468