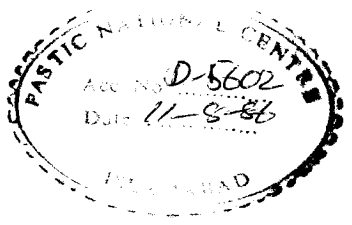
ANNUAL REPORT

FOR THE YEAR 1974-75

Pakistan Science Foundation
Islamabad

PAKISTAN SCIENCE FOUNDATION

ANNUAL REPORT
1974-75



LETTER OF TRANSMITTAL

Islamabad

Dear Mr. Minister:

I have the honour to transmit herewith the Second Annual Report of the Pakistan Science Foundation, for the Fiscal year 1974-75, alongwith its audited accounts, as adopted by the Board of Trustees, for submission to the National Assembly as required by the Pakistan Science Foundation Act III of 1973.

Respectfully,

Z. A. Hashmi

(DR. Z.A. HASHMI)
Chairman, Pakistan Science Foundation

Malik Mohammad Jafar,
Minister of State for
Science & Technology,
Provincial Coordination
and Cultural Affairs,
Government of Pakistan,
ISLAMABAD.

PAKISTAN SCIENCE FOUNDATION

Chairman

Dr. Z.A. Hashmi, M.Sc., D.V.M., D.Ag., D.Sc., F.P.A.S.

Executive Committee

Dr. Z.A. Hashmi	Chairman
Dr. S.M. Qureshi	Member (Science)
Dr. Hafizuddin Ahmad	Member (Finance)

Board of Trustees

Three whole-time Members appointed by the President:

Dr. Z.A. Hashmi	Chairman
Dr. S.M. Qureshi	Member (Science)
Dr. Hafizuddin Ahmad	Member (Finance)

Sixteen part-time Members appointed as follows:

Chairman National Science Council, Ex-Officio
Dr. M.S.H. Siddiqi.

Four Scientists nominated by the National Science Council.

Dr. M.A. Kazi, Chairman, University Grants Commission, Islamabad.

Mr. Ashfaq Hasan, Member Technical, CDA, Islamabad.

Professor S. Marghoob Ali, Department of Chemistry, University of Peshawar, Peshawar.

Professor N.M. Talpur, Chairman, Department of Mathematics, University of Sind, Jamshoro, Hyderabad.

Eleven Eminent Scientists nominated by the President:

Professor Abdus Salam, F.R.S., Imperial College of Science and Technology, London.

Dr. Salim-uz-Zaman Siddiqi, Vice-Chancellor, University of Karachi.

Dr. M.S.H. Siddiqui, Chairman, Pakistan Council of Scientific and Industrial Research, Karachi.

Mr. Munir Ahmad Khan, Chairman, Pakistan Atomic Energy Commission, Islamabad.

Lt. Gen. M. Ayub Khan, Peshawar.

Mr. Manzoor Ahmad, Additional Secretary to the Government of Pakistan, Ministry of Fuel, Power & Natural Resources, Islamabad.

Dr. M. Aslam Khan, Chief Scientist and Scientific Adviser to the Ministry of Defence, Defence Science Organization, Rawalpindi.

Mr. Sarfraz Khan Malik, Joint Secretary, Economic Affairs Division, Islamabad.

Dr. M. Yaqoob Bhatti, Additional Secretary to the Government of Pakistan, Ministry of Food, Agriculture and Rural Development, Islamabad.

Mr. Abdul Mannan Khan, Director-General, Geological Survey of Pakistan, Quetta.

Dr. M. Afzal Kazi, Dean Faculty of Agricultural Engineering, University of Agriculture, Lyallpur.

(b) The Foundation shall also:-

i) review the progress of scientific research sponsored by the Foundation and evaluate the results of such research;

ii) maintain a National Register of citizens of Pakistan, who are highly qualified and talented scientists, including engineers and doctors, in or outside the country, and to assist them, in collaboration with the agencies concerned, in finding within Pakistan employment most suited to their genius; and

iii) cultivate liaison with similar bodies in other countries.

As will be seen from the statement of the functions entrusted to the Foundation, its responsibilities are wide ranging. These include four broad areas of activity: (1) research support and building institutional capability for scientific work, (ii) establishment of a national scientific information system, (iii) promotion of public understanding of science and assistance in the utilization of the results of research and the transfer, generation and application of appropriate technology, and (iv) utilization of the scientific man-power and arresting the flight of talent from the country.

In order to improve the capability of the Pakistan Science Foundation for the performance of the above-mentioned tasks, a joint Pak-American Science Review Team was constituted to make an expert and critical study of the PSF and define its future role in the development of a competent scientific community dedicated to the creation of a modern nation and a progressive social order in Pakistan. The Review Team, consisting of three scientists from the US and three from Pakistan, submitted its report to the Government after the completion of the second phase of its work, based on the visits of Pakistani Scientists to important U.S. Scientific and Technological establishments. (pls. 1 & 2).

The terms of reference of the Team, as laid down by the Government, were as follows:

INTRODUCTION

The Pakistan Science Foundation was established on June 30, 1973, under the Pakistan Science Foundation Act No. III of 1973 (Annexure-I), "to promote and finance scientific activity having a bearing on the socio-economic needs of the country". Under the Act, the Foundation has been entrusted with the following functions:-

(a)
- i) establishment of comprehensive scientific and technological information and dissemination centres;
- ii) promotion of basic and fundamental research in the universities and other institutions, on scientific problems of national significance relevant to the socio-economic development of the country;
- iii) utilization of the results of scientific and technological research, including pilot plant studies to prove the technical and economic feasibility of processes found to be promising on a laboratory scale;
- iv) establishment of science centres, clubs, museums, herbaria and planetaria;
- v) development of learned bodies, scientific societies, associations and academies engaged in spreading the cause of scientific knowledge in general or in the pursuit of a specific scientific discipline or technology in particular.
- vi) organization of periodical science conferences, symposia and seminars;
- vii) exchange of visits of scientists and technologists with other countries;
- viii) grant of awards, prizes and fellowships to individuals engaged in developing processes, products and inventions of consequence to the economy of the country; and
- ix) special scientific surveys not undertaken by any other organization and collection of scientific statistics related to the scientific effort of the country.

Plate No. 2 Pakistan Members of the Joint Pak-American Science Review team on their visit to the National Science Foundation of U.S.A.

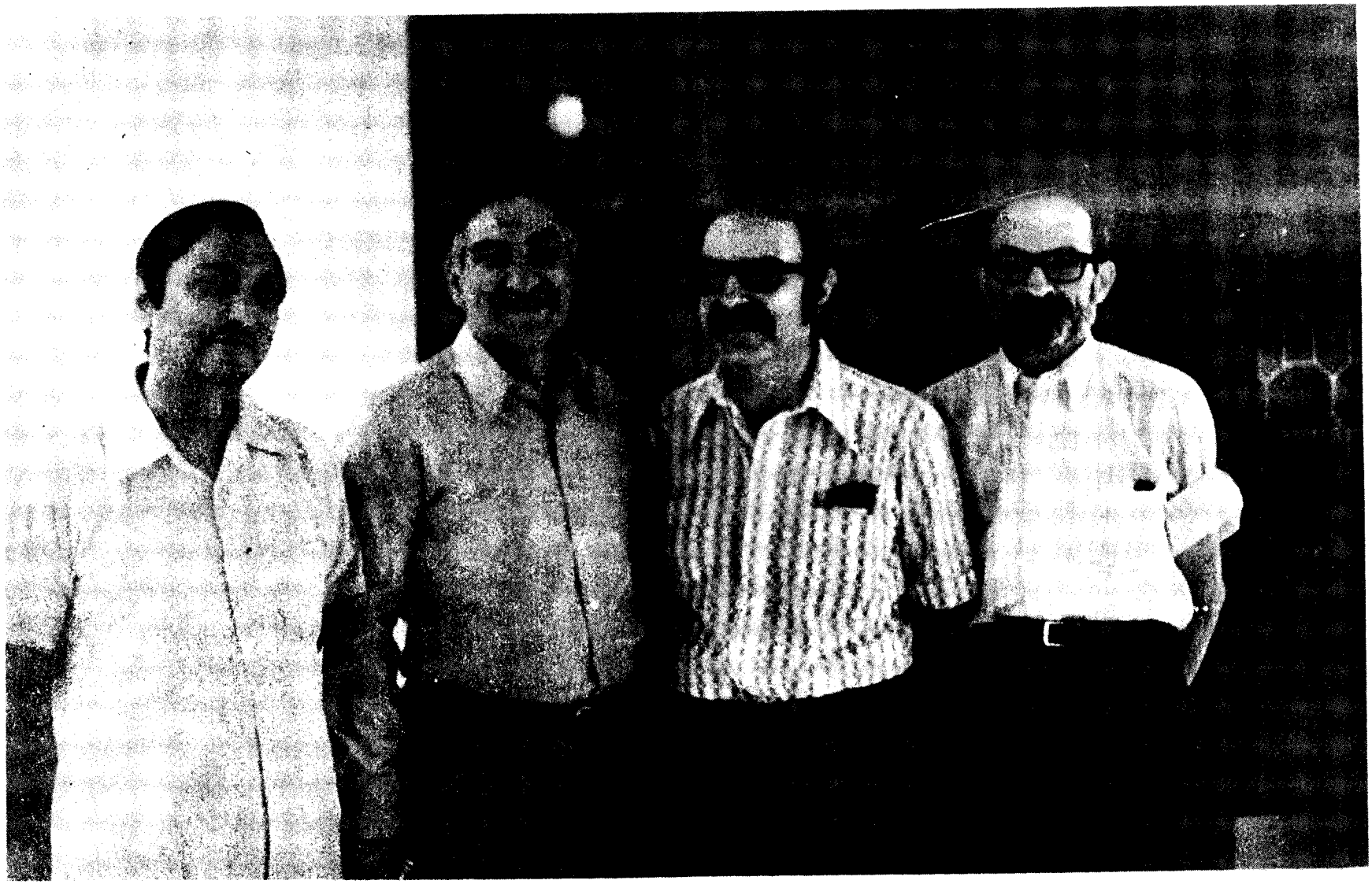


Plate No. 1 U. S. Members of the Joint Pak-American Science Review team on their visit to Pakistan Science Foundation.

C O N T E N T S

List of Illustrations

LIST OF ABBREVIATIONS

Provinces:

B	Baluchistan
C	Centre
F	Frontier
P	Punjab
S	Sind

Sponsoring Institutions:

AC	Agricultural College
AU	Agricultural University
EU	Engineering University
IU	Islamabad University
KU	Karachi University
MH	Mayo Hospital
PU	Peshawar University/Punjab University
SU	Sind University
KMC	Khyber Medical College
NHL	National Health Laboratories
CSIR	Council of Scientific & Industrial Research
JPMC	Jinnah Post Graduate Medical Centre
NIAB	Nuclear Institute for Agriculture & Biology

Disciplines:

AGR	Agricultural Sciences
BIO	Biological Sciences
ENG	Engineering Sciences
MED	Medical Sciences
PHY	Physical Sciences
CHEM	Chemical Sciences
MATH	Mathematics & Computer Sciences
EARTH	Earth Sciences
OCEAN	Oceanography

To consider and make suitable recommendations on:

i) The development of appropriate structure, programme, priorities and procedures of the Pakistan Science Foundation;

ii) Financing of scientific research and programmes by the Foundation;

iii) Promotion of research and strengthening of competence and capability of institutions and centres of scientific research;

iv) Establishment of scientific and technological communication, information and documentation centres;

v) Utilization of results of research;

vi) Establishment of institutional links with scientific bodies in the U.S., and exchange of scientists;

vii) Development of collaborative scientific research programmes with the U.S. institutions; and

viii) The needs of the Foundation for funds, training facilities, expert assistance, equipment, books, journals and other materials.

In addition to general observations on the state of Science and Technology and the future lines of development, the Team made specific recommendations concerning the Pakistan Science Foundation which are given below, seriatim according to the terms of reference of the team.

Item 1 : The appropriate structure, programme priorities and procedures of the Pakistan Science Foundation.

(a) Appropriate structure:

1. The structure of the Foundation, as developed under the Pakistan Science Foundation Act and approved by its Board of Trustees, has been examined and is considered to be generally sound. In addition to the whole-time staff of the Pakistan Science Foundation, it also provides, through the establishment of expert and advisory panels and committees, sufficient scope

and flexibility to take advantage of the knowledge and experience of talented scientists and technologists working in government, the universities and the industry.

2. The present strength of the PSF staff is too small for the extensive programmes in hand and it is recommended, that the full complement of the staff, as envisaged for 1975 in the Administrative Structure Chart in the PSF Brochure entitled PSF Guide to Programmes, should be recruited as early as possible.

As regards future development, it is suggested that the Foundation may, in due course, have separate wings for: (i) science, (ii) technology, (iii) information, documentation and publications, (iv) planning, coordination and evaluation, (v) administration, and (vi) finance and accounts.

3. In the service area, in addition to PASTIC which should be developed expeditiously, the Foundation should develop a Centre for Research Utilization and Special Projects (CRUSP). The Centre should have adequate authority delegated to it by the Foundation to develop and undertake special projects of nation-wide significance for the creation and transfer of appropriate technology and its application.

4. The approach of the Foundation in utilizing the talent of outstanding scientists and eminent scholars in its technical committees and advisory panels, and associating them on a wide basis in the over-all R & D effort of the country, is considered to be a sound method for securing their help and cooperation. It is, however, recommended that as far as its major 'thrust' programmes are concerned, the Foundation should apply the "Think-Tank" approach, e.g. CRUSP should have about a dozen experts of the highest capability and calibre representing the broad spectrum of technically related disciplines, such as, Physics, Chemistry, Biology, Engineering, Economics and Sociology. These men should work together in a highly inter-active fashion sharing their knowledge and expertise so that an integrated and dynamic approach is developed for the solution of complex problems. The Foundation should also draw upon or borrow capabilities of other specialists in the nation for specific tasks. These Special Associates should be organized into Project Teams.

5. It is strongly recommended that the structure of the PSF should not be allowed to develop as a rigid and hierarchical bureaucracy. It should have sufficient flexibility and should be able to expand or contract according to needs.

6. The Foundation should set up a Standing Review and Evaluation Committee (SREC) to advise the PSF Chairman about the progress of the work, pin-point deficiencies and suggest

remedial measures. The SREC should be delegated sufficient powers to appoint adhoc sub-committees whenever necessary for specific tasks. An important sub-committee of SREC may be for 'Technology Assessment' which implies the evaluation of the adverse alongwith the beneficient effects of technological innovations. Needless to say technological development could create very deleterious consequences for human environment, the quality of life of the people and for cherished cultural patterns.

7. As an important point concerning the structure of the Foundation, it is recommended that a whole time post of 'Member Technology', in addition to the posts of Member Science and Member Finance, should be created and filled immediately, in order to provide vigorous leadership to the PSF programmes for the utilization of results of research and application of science for national development.

(b) Programme Priorities:

8. The programme of the Pakistan Science Foundation must necessarily be linked with the achievement of national goals and planned targets. Where the scientific knowledge and technology have already been created for the attainment of a national goal, these should be identified and an appropriate mechanism for their utilization devised. Where the basic knowledge or technology exists but requires to be adapted to local conditions, the necessary adaptive research should be arranged for. And where basic understanding and knowledge is lacking, fundamental research should be vigorously pursued, if necessary, with the collaboration of regional or inter-national research establishments. The support of R & D for the achievement of national goals should, thus, constitute the first priority for PSF and to that end it should develop long-term coordinated programmes for the attainment of specific objectives.

9. In the scientific and technical service area for the PSF, it is suggested that the highest priority should be given to the acquisition, retrieval, analysis and dissemination of scientific and technical information. This should include not only the expeditious establishment of the Pakistan Scientific and Technical Information Centre (PASTIC) as a constituent unit of the Pakistan Science Foundation but also the support of universities, research councils, research institutions and other users of science and technology in developing their capability for fully benefitting from the National Information System, as well as, the international net-works of scientific and technological information.

10. Ancillary to the facilities created inside the country, it is strongly recommended to establish PSF Information Unit, attached with the Pakistan Embassies in the scientifically more important regions of the world. It is obvious that without rapid access to such information available in the major science-technology creating centres of the world, the Foundation will not be in a position to fulfil its most important statutory

mandate. It will be the duty and responsibility of such Science and Technology Information Units to acquire and forward to the PASTIC information regarding the important developments in science and technology. It is suggested that a beginning should be made forthwith by creating a PSF Information Unit in the USA.

11. There are in many parts of the developed world, scientists and scholars of Pakistani origin, able and willing to provide information, advice and assistance. Such men should be organized for the purpose by providing financial assistance from the PSF. The USA and Canada have a large number of such persons and a model organization, located in Washington D.C., could be promoted and financially supported by the PSF.

12. Another high priority area is Technology Transfer. The current cost of Technology Transfer in Pakistan is exorbitant; it is estimated to be Rs.100 million annually. The PSF should assist in reducing costs by arranging expert evaluation of the imported technology, by suggesting substitute low-cost technology, by promoting the utilization of results of research from Pakistan's scientific and technological establishments and by supporting innovations and adaptive research.

New forces generated by the population explosion and social mobility are resulting in a mass exodus of village people into the cities, causing unmanageable problems of slum creation and urban degradation. Major new initiatives are needed to provide employment to the people in rural orbits. The Foundation should pay special attention to labour-intensive, low-cost, intermediate technologies, which utilize locally available resources both material and man-power, and hence would benefit the mass of people. Particular attention should be paid to identify technologies, which have been evolved by countries with conditions similar to Pakistan through a process of innovation and adaptation to suit local needs.

13. Programmes for rural technology and intermediate technology development should aim at surveying the needs, methods, resources and the feasibility of setting up the production of critically needed products in village. Emphasis should be placed on items such as fuel gas, fertilizers, food preservation, sheap building materials and technology, utilization of crop wastes and other such technologies which could be generated locally on a more economical scale. Projects aimed at developing and utilizing energy resources should give special attention to non-conventional sources.

14. A basic factor affecting the health of Science in the nation is the poverty and poor quality of academic science, necessitating major new initiative by the PSF

for improving the scientific capability of institutions of higher education. This should emphasize both support for the creation of infra-structure and the provision of research personnel. It may be stressed that while goal-oriented research should be given a high priority, exclusive concern for such research can become self-defeating. It can unfortunately lead to the neglect of basic and fundamental research and thus inhibit the creative impulses of imaginative scientific workers. Time and again free un-trammelled research has conferred practical benefits of far-reaching import on man-kind. The Foundation should also give all possible support to the universities for the purpose of promoting advanced studies and research including the use of new educational technology and methods and the modernization of science curricula and training of scientific and technical man-power.

15. The PSF should specifically support and promote the wider application of computers in research and collection of statistics, and PSF should also assist the setting up of modern instrumentation facilities for analytic work.

16. Pakistan's major constraint affecting national productivity and all other aspects of life and living is its aridity. Scattered and isolated studies concerning arid environment have been conducted in the past in meteorological, agricultural, forestry, medical, veterinary and irrigation research centres. It is not possible for any one institution to undertake the wide range of studies in the numerous disciplines involved and only a nationally coordinated and cooperative programme with the participation of scientists from different universities, research councils and research institutes has the possibility of making a significant impact. A great challenge and opportunity exists for the Pakistan Science Foundation to develop a coordinated and comprehensive programme of studies on aridity, both basic and applied, en-compassing the total environment, such as climate and climate modification, water and water resource development, soils, desert formation, salinity and erosion, adaptation and productivity of animals and plant life, and human ecology and medical climatology.

17. The benefits of research and development should not be confined to the more developed regions e.g; the green revolution has so far benefitted only the irrigated areas. It should include the ecologically less favoured regions and the poorer sections of the population by giving special attention to dry-farming, coarse-grains, and livestock production on the range lands. The vast resources of these areas have not been adequately surveyed. The PSF should follow up the initiative it has taken in arranging the Science Expedition to the Northern Areas by arranging similar expeditions to Tharparkar, Baluchistan, Cholistan etc., to explore natural resources and identify opportunities. PSF should also investigate the possibility of using newer and more effective techniques for these surveys such as the satellite based remote sensing and air-borne geophysical instrumentation.

18. The Arabian Sea and the Persian Gulf waters are amongst the richest in the world in terms of natural resources, both mineral and biological. The scientific inventory and utilization of these ocean resources should receive PSF support on a priority basis. These potentially extensive and valuable resources should be fully exploited for the benefit of the nation.

19. As the national lead agency for the financing of scientific research, the utilization of results of research and the application of science and technology. PSF would inevitably affect the scale and character of the national scientific endeavour and policy. PSF should, therefore, develop a programme of expert studies of all facts of science policy encompassing institutional structure, high-level man-power planning, identification of priorities and tasks, and the funding of scientific programmes etc.

20. Scientific Equipment is a Sine qua non of scientific activity and the PSF should have the resources to ensure that scientific equipment is made available to creative scientific workers and maintained in good working order. It is understood that scientific and technical equipment worth Rs. 500 million is lying unused in various laboratories in Pakistan for want of minor repairs and spare parts. To remedy this situation it is recommended that the PSF should arrange for the setting up of an Equipment Maintenance Service, and should develop advisory service for the purchase, installation and operation of equipment, and for ensuring its standards, the proposed service may be provided by establishing a Centre which may be called Scientific Equipment Maintenance and Technical Assistance Centre (SEMTAC).

21. There also exists an immediate need to create a visible focus for Pakistani Science, by constructing a Science Centre Building in Islamabad. A serious deficiency of the infra-structure of science in Pakistan is the lack of accommodation for not only non-governmental but also governmental science organizations. Most of these, including the National Science Council, the Pakistan Science Foundation, the Irrigation Research Council, the Housing Research Council, the Medical Research Council, the Pakistan Academy of Sciences, and the Association for the Advancement of Science are located in rented residential type houses or on borrowed space in other institutions, without any facilities for meetings, conferences, libraries, audio-visual aids, etc. They are dispersed throughout the country and interaction among them or with the scientific community is, therefore, very difficult. A high priority should be given to the proposed Science Centre Building at Islamabad to facilitate inter-communication between various groups and individuals. This Science Centre should house the National Science Library and other facilities for dissemination of information and transfer of technology. It should also act as the National headquarters for the popularization and promotion of science through publications and

mass media materials exhibition.

(c) Procedures:

22. The PSF procedures are in line with those of similar institutions in the U.S.A. We generally endorse the method of peer review of research proposals, but it is suggested that it be streamlined to reduce the number of approval steps. The dependence on committees and experts for reviews of research proposals should also be reduced, and the Foundation's technical and scientific staff increased substantially to ensure expeditious response. Greater authority should be vested in the permanent staff of the Foundation in evaluating research proposals. In the case of application for small amounts of financial assistance, it is recommended that a quick one-step internal review by a responsible person within the PSF be authorised.

Item No. 2: Financing of Scientific Research and Scientific Programmes by the Foundation:

23. Government has laid down that the PSF would be the National Agency for financing the development of science and technology in the country and has entrusted to it wide-ranging responsibilities from the support of creative scientific research to the promotion of science in society and the provision of services such as Information and Technology Transfer. If the Foundation is to discharge this mandate properly it should be provided with adequate funds for the purpose. The Team finds that the funds granted to the Foundation at present are inadequate for the performance of the tasks entrusted to it.

24. The Team has estimated that the Pakistan Science Foundation shall require during the 5th Plan period approximately Rs. 110 million in capital funds with a foreign exchange component of Rs. 55 million for creating the necessary infra-structure. This amount will cater for the buildings, equipment and other essential needs of Science & Technology Centres, PSF headquarters, PASTIC, CRUSP and SEMTAC. The recurring annual expenditure is estimated to develop to Rs.240 million with a foreign exchange component of Rs. 33 million by the end of the 5th Plan period. Bases for these estimates are given under item 8. The amount needed annually for research support and utilization of research results constitutes the bulk of recurring expenditure. Out of Rs. 240 million, Rs.200 million are estimated to be required for these two activities annually.

25. As regards the expenditure of available funds to perform the various statutory functions entrusted to the PSF, the guide-line for the next year's budget would be provided by the programme priorities established as a result of the Team's review and the decisions of the Board of Trustees and the Government of Pakistan. There is also an urgent need for the nation to adopt formally a Science Policy. The task of

the Foundation would then be to provide financial support for the implementation of the National policy in respect of Science and Technology.

Term of Reference III:

Item No. 3: Promotion of research and strengthening the competence and capability of institutions and centres of scientific research:

26. It is recommended that the PSF should:

i) identify areas of national need and announce the availability of support for research in these fields;

ii) solicit research schemes from the scientists/technologists in the country and judge their proposals solely on the basis of merit and relevance to national needs;

iii) monitor progress of research and assist in removing bottlenecks, if any;

iv) provide equipment and staff to support academic departments and research centres for the improvement of research;

v) make awards for distinguished achievements to creative scientists;

vi) establish 'Centres of Capability' in research institutes in selected fields and provide specialized equipment, expertise, staff, training, literature, and other facilities, such as travel abroad where necessary;

vii) give high priority to proposals involving inter-disciplinary research and, if necessary, establish special units in research institutes and universities for such inter-disciplinary activities;

viii) provide, along with the grant in support of approved research, an additional sum of about ten percent to the head of the sponsoring institution to be utilized at his discretion for scientific equipment, literature etc. needed to strengthen institutional capability, thereby giving the cooperating research establishments added flexibility in meeting unforeseen needs for scientific activities;

ix) arrange for inter-institutional collaboration at the working level. It is felt that the lack of inter-action between university academicians and scientific officers of Government research laboratories is a major functional problem in the field of science;

x) coordinate its activities and programmes with those of other research councils in the country and for this purpose the Pakistan Science Foundation should be given representation on the governing bodies of the major research councils/organizations in the country.

Term of Reference IV:

Item No. 4: Establishment of scientific and technical communication, information and documentation centres:

27. As the Pakistan Scientific and Technical Information Centre (PASTIC) will be the main focal point for the collection and dissemination of all scientific and technical information it is recommended that its establishment should be expedited by releasing funds approved in the PASTIC scheme, and it should be designated as the central lead agency for liaison with international networks of this type.

28. It would be helpful if the Director of PASTIC is assisted by an advisory board selected mainly from amongst a cross-section of its users, to advise him on matters of general policy. As special problems of highly technical nature are likely to arise, he should be empowered to call together small groups of experts to serve as consultants on an adhoc basis.

29. PASTIC should acquire, process, and disseminate information on all research and development activities relevant to the interests of scientists and technologists in Pakistan. To do so most effectively its staff must remain constantly aware of the ever changing interests of its clientele. This would require constant interaction with its users community, as examplified by attending meetings and visiting research installations. PASTIC should also be able to anticipate information needs and acquire information about the latest advances and innovations. To meet these requirements it has been suggested earlier that the PSF should establish Science and Technology Information Units in various regions of the world preferably with Pakistan Embassies. It should also have information and extension offices at different important centres in the country.

30. Information services for arousing should also be provided to planners, administrators and other responsible officials in the government (both federal and provincial) as well as to entre-preneurs, industrialists and other users of technology.

31. The extension services provided by PASTIC should inter-alia include: (a) delivery of information on request; (b) continuous survey of current literature in specific areas known to be of interest to Pakistani scientists, industrialists and other groups and (c) acting as a coordinating or "Switching" agency in a network of information sources located elsewhere. It is urged that PASTIC should not confine its functions to those of a national library but help in locating the needed information from the network of libraries, data banks, or other similar institutions.

32. The first priority as to acquisition policy, particularly where scarce foreign exchange is concerned, should be the purchase of secondary services i.e., abstracting and indexing system from abroad. Duplication of such services within the country should be avoided as far as possible.

33. An important factor from the point of view of the users is that the required information should be made available to them expeditiously. Every effort should, therefore, be made to reduce the serious time-lag between the request and the delivery of the foreign journal or other source material needed by a local client.

34. There is sufficient need and scope for a network of a regional satellite information centres to be set up throughout the country and integrated with PASTIC. Such centres attuned to specialized interests of its users, will scrutinize and answer most information requests, submitting to PASTIC only those inquiries with which the users cannot cope adequately.

35. All information specialists, including those employed by PASTIC and those engaged by the regional centres, must be trained in the philosophy and functioning of PASTIC. It may be necessary to send some individuals abroad for special training and advanced degrees in Information Science as also for visits to such institutions as the U.S. National Library of Medicine, the National Library for Agriculture etc to study the type of services available to researchers. Efforts should also be made to bring to the country Foreign Experts for short periods to give intensive training to the PASTIC staff and the staff of university libraries in the use of specialized data and information bases available from other countries. The professional staff should be encouraged and subsidized, as far as possible, to participate actively in important conferences on the relevant topics.

36. A special effort should be made to acquaint the actual and potential users of the system by conducting periodic seminars at various research centres in the country. Modern audio-visual methodologies should be employed so that participants can most efficiently learn how the system functions in minimum times.

37 PASTIC should establish formal links with international information systems and professional organizations.

Term of Reference V:

Item No. 5: Utilization of Results of Research:

38. The most pressing problem of Pakistan is to equalize technological levels with the contemporary world. Except in the tiny modern sector, the prevailing technology is traditional and low in productivity. Effective utilization of the results of research from sources as also indigenous sources, technology transfer and its widespread application, is dependent upon the adequacy of institutions, mechanisms and programmes aimed at this specific purpose. The Pakistan Science Foundation should provide this infra-structure. It is strongly recommended that PSF should forthwith establish a Centre for Research Utilization and Special Projects (CRUSP).

39. CRUSP would have the responsibility for: (a) collecting, processing, and analysing R and D information and experience; (b) forging effective contacts with R and D establishments and maintaining liaison with the potential and actual users of technology in the nation; (c) determining areas of needs and opportunities in the nation and identification of available appropriate technologies/research results which could be profitably transferred; (d) mounting special projects for field operation and utilization of the results of research and improved technologies.

40. CRUSP should be the lead agency in the nation for a coordinating role in moving science and technology from the laboratories into the field. CRUSP would thus be equipped to supply: (i) information about available know-how and management expertise (ii) draw up model agreements on the transfer of technology (iii) give technical guidance for the building up of R and D facilities and training of managerial and technical personnel (iv) furnish information about patent literature (v) carry out feasibility studies for multi-disciplinary research (vi) arrange for pilot plant studies (vii) establish links with technology transfer institutions in different countries and regions (viii) act as the feed-back agency to national policy-making for science and economic development.

41. CRUSP should be organized and structured to attain a large measure of flexibility. The CRUSP personnel should consist mainly of three groups: (1) a core of experts (about 10 to 12 men) of the highest calibre representing varied, broad disciplines within science, engineering, socio-economics, and industry; (2) visiting specialists, numbering upto two dozen persons who are invited to be in residence for periods ranging from a few days to several months; and (3) scientific, technical, secretarial, and clerical personnel.

42. Physical facilities of CRUSP be located in the main PSF facility - the Science Centre Building, Islamabad, so as

to facilitate easy communication with PASTIC and the headquarters of national science organizations. These should include office-study rooms (about 36) with telephones and chalkboards, conference rooms and audio-visual aids, a library for general references, a duplicating and printing facility, a lecture theatre (about 100 seats), a general-purpose workshop and laboratory, space for special laboratories and pilot projects, and residential facilities (Guest house) for the visiting specialists.

43. An urgent task in the utilization of results of research for productive purposes is to forge effective links between the R and D laboratories and the potential users of the new technology created at the research establishments. Generating new technology does not by itself result in increasing production. Economic growth depends on the degree to which industry adopts and commercialize improved technology. CRUSP could perform a very important role by supporting technical consultancy and extension services for selected industries to develop model/pilot programmes in collaboration with the appropriate laboratories and industrial groups. The extension work would include provision of technical information, advice and assistance in quality control, trouble shooting, engineering adaptation, process development and new products. In the bigger industrial enterprizes R and D groups should be promoted and partially supported to begin with and their liaison established with the appropriate laboratories. An effective mechanism, in the case of small sized industries is the promotion of R and D Association with the financial/technical support of the Pakistan Science Foundation and Industry. The Pakistan Science Foundation should also encourage interchange of personnel between scientific establishments, the universities and the industry. Scientists working in the research institutes and universities should be encouraged to spend a limited amount of time as consultants to industrial concerns. This will lead to better communication between industry and scientists.

44. The backward sections of society, such as the rural masses and the undeveloped areas in the nation, must be enabled to benefit from a massive in-flow of improved and more productive technology. This would be possible only when social institutions, such as the village cooperatives, and administrative mechanisms such as the Integrated Rural Development Programme are extensively deployed for the purpose. CRUSP should ensure the involvement of such institutions and programmes in developing projects for the field application of science and technology.

45. CRUSP should, to begin with, organize model/pilot projects and develop patterns of success for extension of technology which could be developed into mass application by the central and provincial government agencies concerned. The CRUSP staff should mainly be organized into teams of 3 to 4 persons who will focus attention on the special projects developed by the core experts and visiting specialists. In view of the responsibility to solve national problems of

changing nature, it would be inappropriate to limit their flexibility. Means should be provided to quickly decrease, add, change, or exchange facilities and personnel.

46. Better use should be made of the Patent Office and its holdings. In particular, detailed information about patents from the advanced nations should be obtained as a means of transferring technology. CRUSP should study the problem and, if necessary, obtain the assistance of the Patent Cooperation Treaty Organization.

47. As methods, techniques, and industrial processes, successfully adapted and introduced by CRUSP, would necessarily be transferred to appropriate groups, institutions or industry, close liaison with such agencies should be maintained constantly. Where-ever possible, pilot projects of field application should be developed in collaboration with such agencies and efforts should be made to encourage the cooperatives etc. to become involved in and promote the emergence of R and D associations when dealing with similar scale industries.

48. CRUSP may also organize consultancy groups for feasibility and other studies in the application of science and technology to industrial and farming enterprizes.

Terms of Reference VI:

Item No.6: Establishment of institutional links with scientific bodies in the U.S. and exchange of scientists:

49. One of the Team's main terms of reference was to suggest what institutional links could be established between scientific bodies in Pakistan and U.S., and how the exchange of scientists between the two countries could be arranged. In this connection it may be suggested that PSF should extend and develop present links with USAID, NSF, and other US governmental and non-governmental agencies interested in scientific and technical cooperation.

50. It may also be recommended that PASTIC should extend and develop links with U.S. information systems and centres, such as, MEDLARS, AGRIS, Chemical Abstracts, Arid Zone Information Centre of the University of Arizona, National Technical Information Service (NTIS) and other appropriate agencies. PSF may contract with NTIS to become its focal point in Pakistan for the in-flow of NTIS's rich resources in research/technical reports and documents.

51. It may be further suggested that CRUSP should develop relations with such U.S. organizations as the Battelle Memorial Institute and BOSTID of the National Academy of Sciences, and a careful study should be made of the organization and approach of such agencies as the AEROSPACE Corporation for the performance of R and D tasks.

52. A glaring deficiency is the lack of standardising laboratories in Pakistan. These are important buffers against obsolescence and for ensuring continuous advance from current to improve levels of technology as well as quality control which are basic to high productivity and securing export markets. The U.S. National Bureau of Standards could greatly help CRUSP through seminars, training facilities, collaborative research and expert advice.

53. It is recommended that the PSF should adopt a role of generally stimulating and arranging links of communication and scientific exchange between scientists, laboratories, industries, institutions and universities both within and outside Pakistan.

54. The PSF should also make arrangements for collaboration between pairs of scientists, one in Pakistan and one in the U.S., who are engaged in similar research and are willing to collaborate.

55. Such collaboration and pair formation should also be encouraged between laboratories and/or departments of universities in Pakistan and the U.S., having similar research and development objectives and desire to share and participate in each others activities.

Term of Reference VII:

Item No.7: Development of collaborative scientific research programmes with US institutions:

56. The general patterns of collaborative research are already well established with the U.S. N.S.F; the Smithsonian Institute, the Agricultural Research Service, the Environmental Agency etc, but the extent of such collaboration could be substantially increased to the mutual benefit of Pakistan and the U.S. It may be urged that PSF should be designated as the lead Pakistan agency to organize and promote collaborative activities in energy research and research nutrition, agriculture with special emphasis on legumes, coarse grains, beef, poultry and fish production and utilization of agriculture wastes, fermentation, tropical diseases, marine biology, environment and population.

57. To the extent possible, and as far as practicable, both are applied and fundamental scientists should be involved in such collaboration, from the universities as well as the research laboratories.

58. To facilitate such collaboration, PSF should develop a broad program of seminars and workshops with the participation of scientists and engineers from both countries. There should be advanced planning so that prospective collaborators might explore areas of mutual interest, and work out practical arrangements for their collaboration well ahead of time.

Term of Reference VIII:

Item No. 8: The Needs of the Foundation for funds, training facilities, expert assistance, equipment, books, journals, and other materials:

59. The nature of responsibilities and tasks entrusted the PSF are very broad and formidable. The imperative of providing substantial funds to PSF on continuing basis therefore cannot be over-emphasized. Since the Foundation will concern itself with the revitalization of academic research, inter-connecting existing research and development activities, promoting science and technology relevant to national needs, the success of its efforts will, to a large extent, depend on the adequacy of financial sources.

60. After reviewing the existing budget of the PSF vis-a-vis the magnitude of its statutory obligations, the Team finds that the present budgetary allocations are woefully short of minimal requirements. Following is an estimate of the minimum needs of PSF for the next five years (5th Plan period) based on an objective analysis of functions:

Capital Expenditure:

	Pak Currency Rs: Million	Foreign Exchange Component Rs: Million
1) Headquarters of PSF net-work of Science Libraries and Communication Links, Physical facilities for CRUSP, SEMTIC.	100	50
2) Building and Equipment for PASTIC and its Sub-Centres.	10	5
	110	55

Recurring Expenditure: (1979-80):

1. Grants for research support.	100	10
2. Information and documentation.	5	1
3. Utilization of results of research and technology transfer.	100	20
4. Science Centres, herbaria, clubs and museums.	20	-
5. Science conferences, including meetings of PSF Board and Committees, seminars and workshops.	2	0.2

6.	Exchange of visits of scientists and technologists.	2	1.0
7.	Awards, prizes and fellowships.	1	0.5
8.	Scientific surveys and collection of statistics	1	-
9.	Experts and consultants	2	0.3
10.	Scientists' Pool	1	-
11.	Scientific societies and professional bodies.	1	-
12.	Administration	5	-
		240	33.0

Endowment Grant:

61. The income of the Pakistan Science Foundation is derived at present exclusively from the annual grant provided for it in the Federal Government budget. Additional sources of income should be mobilized by arranging for: (1) an endowment grant, and (2) Provincial Government Grants.

Endowment: PSF has to negotiate each year with the administrative Ministry as well as the Finance Ministry for funds. There is always an element of uncertainty in such a procedure. On the other hand most of the scientific schemes and research projects supported by the PSF have a minimum duration of three years or more. It is, therefore, essential that PSF should have the ability to provide un-interrupted support to on-going projects till the projects are successfully concluded, without tying up such support to the annual negotiations with Government. In order to ensure continuance of research activity, the Team recommends that an endowment grant of Rs. 200 million out of PL-480 funds may be negotiated with USAID. Use of PL-480 funds for endowment is better than direct grant of U.S. owned rupees in that it will not create inflation in the country. The Principal shall remain intact and ordinarily only income derived from interest or investments shall be used to augment operating costs for essential PSF activities. According to the current bank rate, an endowment of Rs. 200 million can yield approximately Rs. 200 lac annually. Such endowment by private philanthropy has provided a bulwork of strength to the advancement of knowledge and the welfare of mankind, and Pakistan is familiar with the value of such investment in the Maxican wheats and IRRI rice evolved through the Ford and Rockefeller Foundation.

Provincial Contribution: As most of the funds would be spent in the provinces which would derive benefits therefrom, it would be just and fair if the provincial governments also contribute their quota to the regular income of the PSF. As a feasible and practical governments may make a modest annual contribution to the PSF at the rate of 2 percent of their public sector annual recurring expenditure. This quota, the PSF would undertake to

spend exclusively in the province contributing it. Such cost would secure the active involvement of the provincial governments in PSF work, thereby relating its work to the felt needs of the provinces.

Utilization of Foreign Aid Offers:

62. Pakistan at present is not deriving full benefit from the facilities and funds for science and technology under foreign aid and technical assistance programmes available through various international organizations, the United Nations agencies and under bilateral cultural pacts with friendly countries. We feel that a centralized arrangement for dealing with all such aid and assistance programmes in the sphere of science and technology would lead to the maximum utilization of the facilities offered by the foreign agencies and governments. The PSF should be the most suitable organization for this purpose, and it is recommended that government may declare it as the coordinating technical agency in Pakistan for international assistance in the field of science and technology. This would ensure the most profitable utilization of international assistance and talent available to the country. A list of aid-worthy projects is at annexure X.

63. A number of U.S. establishments were noted to exhibit outstanding programmes which could be considered very relevant to those proposed for the PSF. Effective liaison should be developed between the PSF and such agencies in the U.S. as have similar interest. Pairing of sister-hood rleationships for collaborative research and links for other PSF activities could be developed with great advantage and the Team's recommendations in this behalf are given under Term of Reference IV.

Agreement with US AID:

64. The Pakistan Government may consider negotiating an agreement with the US AID to provide to the Pakistan Science Foundation the support needed for developing the infra-structure, services and programmes to undertake its statutory functions effectively. The aid may be secured for (1) an endowment fund from PL-480 money, (2) capital and recurring cost for equipment, literature, staff, training, advisory services, exchange of visits, seminar, support and creation of infra-structure. The following table gives the PSF needs in terms of financial requirements during 1975-80 for technical assistance and project support:

Project	Advisory Services	$ U.S. Training	Equipment	Total
A) PASTIC	50,000	114,000	480,000	644,000
B) CRUSP	210,000	84,000	2,000,000	2,294,000
C) SEMTAC	120,000	42,000	1,500,000	1,662,000

Project	Advisory Service	$ U.S. Training	Equipment	Total
(continued from pre-page)				
D) Science Centres	45,000	21,000	1,000,000	1,066,000
D) Building Research Capability	30,000	1,530,000	1,000,000	2,560,000
Total:	455,000	1,791,000	5,980,000	8,226,000

Say U.S. $ 8.23 million

Approval of review team's recommendations and follow-up:

The recommendations of the Joint Pak-American Science Review Team were considered and approved by the Foundation's Board of Trustees as well as the Minister of Education, Science and Technology and Provincial Coordination. Action has been initiated on the implementation of the recommendations. A portfolio of schemes and projects based on the team's recommendation was prepared and submitted to the S & T R Division. The S & T R Division has requested the Ministry of Economic Affairs to negotiate with the US AID, the UNDP and the Government of Netherlands for technical and financial aid for the project.

CHAPTER - I

ACTIVITIES AND PROGRAMMES:

The activities and programmes undertaken by the Foundation during the year under report are out-lined below:-

Establishment of the Pakistan Scientific and Technological Information Centre (PASTIC):

As reported earlier, the government has approved a project for the establishment of the PASTIC - a national information net-work under the auspices of the Pakistan Science Foundation at an estimated cost of Rs. 1,01,70,056 and an annual recurring expenditure of Rs. 1,57,90,051. It is a five-year project and envisages the establishment around the existing nucleus of the Pakistan National Documentation Centre (PANSDOC), a national centre at Islamabad with four sub-centres at Karachi, Lahore, Peshawar and Quetta.

A nucleus staff was transferred from PANSDOC Karachi to Islamabad and the National Centre of the PASTIC started functioning on a modest scale in Islamabad in a rented building with effect from September 14, 1974.

The National Centre at Islamabad would provide the following facilities:-

i) National Science Reference Library
ii) Documentation service
iii) Scientific and technological information transfer services
iv) Facilities for scientific publications; and
v) Facilities for compilation of scientific statistics.

The work accomplished in respect of the above objectives is as follows:-

National Science Reference Library:

List of about 2,000 reference books and 510 journals to be obtained for the National Reference Library were prepared.

A national inter-disciplinary adhoc committee consisting of 16 members was constituted, and its meeting was called at Islamabad on 25th February, 1975 to examine the list of books and journals. In view of financial limitation the list of journals was curtailed from 510 to 191 by the committee.

Licences for the import of books, journals and equipment were obtained from the Chief Controller of Imports and Exports.

Letters of credit were opened in the National Bank of Pakistan and orders are under process for the procurement of these items.

Scientific and Technological Information Transfer Services:

About 200 institutions, which provide S & T information transfer services, were contacted in order to determine the type of information facilities offered by them. It was observed that information from most of the institutions is available on magnetic tapes whereas the computer centre at Islamabad University, which planned to provide the computing services to the PASTIC, has IBM computer wil h memory discs system. Funds were, therefore, provided by the Foundation to the University of Islamabad for the purchase of tape drives, which have since been obtained and are under installation at the computer centre at the University.

The Institute of Scientific Information in the USA and the National Technological Information Service of the USA were contacted for obtaining the current contents and the NTIS report services. This information is being received from both the organizations and disseminated to the Scientific institutions of the country.

Documentation services:

The existing facilities of the Karachi sub-centre of the PASTIC (old PANSDOC) continue to provide documentation services. These services include document supply service, bibliography, translation and document reproduction.

A Patents Information Cell was established at the PASTIC Sub-Centre Karachi. A programme is being drawn up for the Patent Information Cell to provide Current Awareness Service on Patent Literature to the users.

Computer Services:

An agreement was signed with the Computer Centre of University of Islamabad for processing information provided by the PASTIC. The programme consists of cataloguing of a Union, list of scientific and

technological periodicals held in Pakistan libraries; the Pakistan Science Abstracts covering a period of 15 years, indices of theses and government reports.

Compilation of Research and Development Statistics:

Information with regard to S & T workers and the field of their specialization was collected on a pilot scale from the PCSIR.

A questionnaire was circulated for collecting statistics on research projects presently under progress in 300 institutions of the country.

A survey is being carried out to collect statistics on users' interests. A ten-member committee has also been constituted to assess the needs of users.

Specific Publications:

A list of PASTIC translations, a directory of scientific and technological periodicals of Pakistan, a list of PASTIC Bibliographies, Pakistan Current Contents and Pakistan Science Abstracts are being published regularly.

The directory of scientific institutes in the country is in the press and will be published soon.

Work on the indexing of theses submitted to the universities of Pakistan as well as of the government reports is in progress.

Reprographic Equipment:

The following equipment is being imported at a cost of $18,755.25.

Plain paper copier with reduction attachment

Reader printer, universal type to accommodate 33 mm and 16 mm Roll fill fische and aperture card, fully automatic with dry paper delivery.

Microfiselic readers.

Foreign Technical Assistance for the PASTIC:

A proposal for obtaining the services of two experts under the Netherlands Assistance Programme has been forwarded to the Netherlands Government through the Government of Pakistan.

The request for UNDP Technical Assistance of $ 6,50,000 is under the consideration of Economic Affairs Division.

PASTIC as a focal point:

The PASTIC has been made a focal point for UNISIST, UNEA and Arizona Arid/Semi-arid Zone Information Centre. Liaison is being established for the transfer of the requisite S & T information from their sources.

II. RESEARCH SUPPORT:

The promotion of basic and fundamental research in universities and other institutions on scientific problems relevant to the socio-economic development of the country:

The Foundation carries out its statutory responsibility for the support of research through a number of programmes which include:-

1. Grants of research projects submitted by individuals or groups of scientists in the universities and research institutions.

2. Organization of Integrated Research Programmes.

3. Institutional Support - provision of equipment, literature, staff training facilities, etc., to build institutional capability for conducting research.

4. Support for participation in regional and international research programmes.

A) Grant of research projects submitted by individual research workers or groups of scientific workers:

Research project support is the Foundation's principal programme for the support of basic and fundamental research in the universities and other research establishments.

Sixty proposals requesting for funds totalling about Rs. 2,15,49,201/- were received during the year 1974-75. Eighty proposals costing Rs. 3,78,43,954/- were carried over from the previous year. In all, 140 projects representing all fields of Science were in operation during the period under report. These proposals were undertaken by experts in the fields because of their scientific merit and relevance to national needs according to the criteria laid down by the Foundation. The criteria for research grants are: (a)competence of the scientific personnel available to carry out the research, (b) Institutional capability i.e., availability of requisite equipment, library facilities and support from scientific colleagues, (c) scientific merit of the proposed research, (d) likelihood of completion of the project within the stipulated time. Each proposal after the initial review report is placed before the Technical and other committees of the Foundation. During the year, 41 research proposals, selected by various Technical Committees were approved by the Foundation for a financial assistance of Rs. 62,89,208/-. The distribution, number and amount of grants sanctioned according to the fields of science for fiscal year 1973-74 and 1974-75, are shown in table-I.

TABLE - I

Scientific Research Project Support
for
Fiscal Years 1973-74 and 1974-75

S.No.	Discipline	1973-74			1974-75	
		No. of Schemes	Amount sanctioned	Amount revised *	No. of schemes	Amount sanctioned
1.	Agricultural Sciences	1	3,52,170	361,551	6	16,36,346
2.	Biological Sciences	9	13,84,141	1470,069	13	21,62,504
3.	Chemical Sciences	7	12,31,472	1409,038	9	12,62,804
4.	Earth Sciences	1	3,00,000	300,000	3	3,91,628
5.	Engineering Sciences	1	57,520	57,520	1	35,000
6.	Environmental Sciences	-	-	-	-	-
7.	Mathematics	1	59,520	69,395	1	1,00,000
8.	Medical Sciences	1	14,000	14,000	7	1,86,071
9.	Oceanography	1	1,46,237	146,237	-	-
10.	Physical Sciences	4	3,82,847	441,174	1	5,14,855
	Total:	26	39,27,907	4268,984	41	62,89,208

* Amounts for the projects sanctioned during the year 1973-74 had to be revised due to introduction of National Pay Scales.

The Foundation has constantly encouraged research in all important areas. The response in some areas has been poor due to the lack of high-level manpower or the lack of institutional facilities required for research. The Foundation is endeavouring to improve institutional capabilities in such fields but due to limited funds at its disposal, it is hard to provide requisite facilities to a substantial number of institutions.

Research Project:

Summaries of the research proposals sanctioned during the year 1974-75 are given below:-

1. AGRICULTURAL SCIENCES: P-AU/AGR (5)*

Title: Effects of tractor-powered tillage practices on crop yield and soil characteristics.

The study is aimed at determining the types and combination of different implements for increasing crop yields, measuring the soil properties for suitable tilth and the economics of different tillage operations. A variety of imported/ locally manufactured farm implements are being used in the country for carrying out seedbed operations. It is necessary to make an objective study of efficacy of different types of implements and their most desirable combinations for getting maximum yields per acre for a given crop, with minimum expenditures. There is need to determine the sequence of operations which would create the soil environment for maximizing yields.

S-SU/AGR (13)

Title: Exploration of Nitrogen fixing algae from Agricultural fields of Sind.

Recently, the use of the blue green algae "Cyanophyceae" in improving soil fertility has been gaining currency in the U.S.S.R., India, Japan, the Philippines, Indonesia and other Far Eastern countries. Species of blue greenalgae are being utilized for nitrogen-fixation in rice, sugarcane, tomatoes, cotton and other crops. In view of the high prices of chemical fertilizers and their limited use both due to lack of availability and the high cost the alternate method of increasing nitrogen level of the soils through microbial action would be invaluable for Pakistan. Positive results would help in replacing the expensive inorganic nitrogenous fertilizers by free-of-cost biological entities. The nitrates so generated would add to the fertility of soil without increasing its salt content.

The studies are aimed at collecting, identifying and culturing of the nitrogen fixing species of "Cyanophyceae" from cultivated fields of Sind. The various species will be investigated to determine their nitrogen fixing properties.

*For names of the Principal Investigators and sponsoring institutions, refer Annexure-III.

P-NIAB/AGR (17)

Title: Biological Control of Soil Salinity:

To combat the gigantic problem of soil salinity in Pakistan, several methods have been recommended but the main emphasis has so far been on an engineering approach involving mainly the establishment of a network of tube-wells in different project areas. Although sub-soil water level has been lowered in this way, yet soil salinity has increased in many cases, due to the use of bad quality tube-well water. Little attention has been paid to the ecological conditions and agronomic practices in the affected areas, although it is known that salt-affected soils support the growth of halophytic plants of one kind or another. There is need to combine engineering structures with biological methods for the control of salinity. It is thus a matter of starting a plant succession with halophytes and leading to the cultivation of economic crops in the end. Somewhat similar approach has been adopted by the Dutch scientists who have reclaimed thousands of acres of land from the sea.

The project envisages the adoption of biological and ecological means for reclaiming the saline sodic soils; experiments will be undertaken to identify the most suitable halophytes for initiating the plant succession. In the first instant, Diplanche fusca or kallar grass (a halophyte grass commonly growing in water-logged alkaline soils) will be used as a primary coloniser. The green fodder obtained after the establishment of kallar grass will be used to raise sheep and goats which, in turn will provide farm-yard manure to the soil. The introduction of organic matter will improve the soil structure through irrigation, producing acidic condition in soil for dissolution of calcium carbonate of the calcarions saline soils and additional plant nutrient directly to soil.

The results of these investigations will assist in reclaiming such saline sodic soils which have become barren due to salinity problems and rendered useless for the cultivation of economic crops.

S-SC/AGR (18)

Title: Survey, collection and study of plant mites attacking different crops in Sind and their control:

Fruit trees and agronomic crops all over Sind are subject to heavy depredation caused by a number of attacking Arthropods. The Sind province, especially its Southern part, due to the influence of sea has a climate quite different from other parts of the country and, therefore, the habitat and behaviour of mites of this area are likely to be different from those of the other provinces in Pakistan.

These investigations include a survey of mites, their habits and behaviour. The study on various crops in different seasons will give a fair idea of the population dynamics vis-a-vis the occurrence, intensity and fluctuation of mite population.

The information obtained from these investigations, would facilitate the determination of the optimum time for the control measures against mites in the Sind province.

C-IU/AGR (22)

Title: Studies and evaluation of the physiological changes induced in the biotic community of the agricultural land by the use of pesticides:

The use of pesticides is considered of great importance particularly when other methods of control are not applicable as in emergency situations like locust invasions. Thus, various types of pesticides are being increasingly used as the main economical control measure. Among these pesticides, organo-chlorine and organo-phosphates are the most widely used chemicals. Apparently, these chemicals have provided a fair amount of relief from the agricultural pests, but there is also evidence of deleterious side effects of these chemicals on the crop plants and the dependent animals including human begins.

The project envisages a study of the behaviour of the pesticides inside the bodies of plants and animals and their direct and indirect influences on metabolic activities and reproduction.

These studies will help understand and combat the hazards caused by the use of chemicals for controlling the agricultural pests.

PSF/RES/35 (3)

Title: Veterinary disease investigation in Northern Areas.

The Northern Areas of Gilgit, Diamir and Baltistan are spread over a vast mountainous and sub-mountainous tract where life is generally pastoral and the people depend on livestock for their living. Due to the general backwardness of the area, the lack of trained man-power and industries, the animal husbandry work in the Northern Areas has been completely neglected in the past. Animal diseases have gone unchecked resulting in heavy loss from epizootics and parasitic infestations. Unless disease control problems are carefully investigated and vigorously tackled as has been done, to a considerable extent, in the other provinces of Pakistan, the diseases like cattle plague, pasteurellosis, bru-cellosis, anthrax, mas-titis, and plenro-pneumonia in goats and parasitism and rabies will continue to inflict heavy economic losses in the Northern Areas. Areas of endemic disease have to be mapped as also the routes of movement of animals and spread of disease, so that prophylactic campaigns could be launched. Un-doubtedly, early and timely diagnosis of disease plays a vital and important role in the livestock industry. Hence, the need for adequate diagnostic facilities is of utmost importance as on this depends the nature of preventive treatment to be adopted. It is, therefore, imperative that, besides introducing other measures to improve animal husbandry, we must endeavour to save what we have.

This project also envisages the preparation of a few selected vaccines like sheep-pox vaccine, fowl-pox vaccine, Ranikhet vaccine, etc. which would be prepared for mass-scale use at low cost. Attempts will also be made to study the epizoo-tological profile of the area from year to year to plan disease prevention programmes realistically.

The studies will not only check the loss due to infection of parasitic, bacterial and other diseases but will also improve the standard of animal health in general. The gross losses in the production of milk, meat, hides, and their by-products, will also be reduced.

II. BIOLOGICAL SCIENCES:

P-PU/BIO (6)

Title: 1) Palynological studies of the plants growing in the Punjab:

2) Seasonal variations in the frequencies of Air-borne pollen and spores which cause allergies with special reference to Central Punjab:

Certain types of spores and pollen grains remain suspended in the air during dry season and are known to cause Asthma and allergies. Palynological studies deal with the morphological details of pollen grains and spores.

The project is aimed at the collection and the study of morphological details of the fungal spores as well as the pollen grains of plants growing in the Punjab. Seasonal variations in the frequencies of airborne pollen and spores, which are known to cause allergy and asthma, will also be studied.

The proposed studies, in addition to their scientific merits, will assist in identifying the causative agents of various allergies and other related diseases.

P-PU/BIO (9):

Title: Investigation into the Occurrence, Biology and Histo-Chemistry of Larval Trematodes in Pakistan:

The trematodes are very important as parasites and are responsible for a number of diseases of man (Schistosoma), poultry(Prosthogonimus): fish (Diplostomum): Livestock (Fasciola and Paramphistomum) and of game-birds (Echinostoma and many others). In Pakistan, some work has been done on the systematics of adult trematodes whereas no serious attempt has been made to investigate the occurrence and Biology of trematode larvae.

These studies would cover a survey of occurrence and biology of larval trematodes in fresh waters of Pakistan, histochemical studies on the glandular apparatus of trematodes, larvae and the biology of these in relation to the intermediate and definitive hosts.

These studies would provide information regarding the chemistry of the penetration of larvae into the host tissues. These results, apart from being academically important, will be of great help to veterinary and medical scientists in diagnosing and adopting preventive measures for diseases caused by trematodes.

F-PU/BIO (11)

Title: A Faunistic study and Bio-Ecology of Fishes of NWFP:

Fresh water fish constitute an important source of proteins. Proper exploitation of the fish resources would not only increase much-needed protein supplies but would also generate employment for a large number of people.

The project involves a survey of the fresh water fishes in NWFP in order to identify the food fishes. Studies on the biology of food fishes and their ecological environment would also be undertaken. These investigations, in addition to providing an inventory of the NWFP fishes, would also furnish details regarding life history, diseases and natural enemies of the food fishes. The information thus gained would be of value to fisheries biologists, and would lay down the scientific basis for fisheries development in the province.

S-KU/BIO (13):

Title: Utilization of brackish water for growing plants on sandy belts of Pakistan:

In these parts of the world where sweet water is not available for irrigation, use has been made of saline water, for instance for growing wheat in certain sandy belts of India and afforestation using sea water in Kuwait. Other similar experiments have been done in Egypt, Italy and Sicily. Since not only the composition of brackish water differs at different places but also the nature and structure of the soil, it is, therefore, essential to investigate the soil and water conditions in different parts of the country.

The scheme envisages detailed studies on the soil analysis and composition of brackish water at different places. Subsequently, salt tolerant plants will be grown in sandy belts of the country. Other suitable methods for brackish water plantation, will also be explored with a view to evolving a few techniques of saline agriculture.

The results obtained would furnish the requisite information for providing vegetative cover to barren lands now out of production and undergoing further deteriorations.

S-KU/BIO (16):

Title: Systematics, Biology and seasonal abundance of Plankton in the Karachi Coastal Waters:

On the basis of distribution and habitat, marine animals are generally classified as plankton, neckton and benthos The first named comprise all those small drifting organisms: plants and animals, which have only feeble power of locomotion and are carried helplessly on currents and tides. The plankton occupy an important position in the food chains and are the primary source of food for higher animals especially the fishes. Hence they play an important role in the fish biology, mainly the migration of fishes.

The project is aimed at studying (a) Planktons in relation to the physio-chemical factors operating in ocean, (b) role of planktons in food chains, (c) dominance of different plankton species during different seasons, (d) biology of selected zooplanktons, (e) effects of tides and currents on plankton population and (f) diurnal and vertical migration of zooplankton.

Besides their academic importance these studies would be of great help in the scientific exploitation of our marine fish resources, as the abundance or otherwise of planktons has a direct bearing on the yield of fishes.

S-KU/BIO (20):

Title: Taxonomic studies of some Marine Invertebrates of the Northern Arabian Sea (Decapoda, Crustacea, Mollusca and Echinodermata).

Recent studies, undertaken during the International Indian Ocean Expedition, have shown the areas adjoining Pakistan to be amongst the most productive zones of the Indian Ocean. It is, therefore, expected that the coastal waters of this region must abound in marine fauna, the knowledge of which is highly desirable both from the scientific and economic points of view.

The proposed study involves the collection, identification, preservation and intensive biological study of the animals belonging to four classes of invertebrates, viz; Crustacea, Decapoda, Mallusca and Echinodermata.

This study of fauna will strengthen the Karachi Invertebrate Museum which is expected to serve as a reference collection from the North Arabian and adjacent seas. This collection will be accessible to the local biologists as well as the foreign scientists.

F-PU/BIO (28)

Title: Phyto-Ecological survey of N.W.F.P.

There has been a rapid and massive depletion of our forestry resources in the areas comprising N.W.F.P. resulting in numerous deleterious effects. The rehabilitation of vegetation would require a sound understanding of plant ecology in the area.

The proposed studies are aimed at the study of plant environment and the classification of ecological zones with regard to the plant life in the North Western Frontier Province.

These studies, although of fundamental nature, would provide critical information needed for reforestation and improvement of range lands as N.W.F.P. has very little land available for traditional agricultural and horticultural practices.

S-SU/BIO (36):

Title: Survey of trace elements in the soil of Sind Province and their effect on the productivity of wheat, paddy and cotton:

Trace elements are known to play a decisive role in the growth and development of plants. Since plants utilise 300-400 gms of boron and zinc, 500-600 gms of manganese and 80-100 gms of copper from soil annually, this results in depletion of trace elements in the soil every year and unless supplemented in the right proportion, will continuously reduce the production of food grains.

The object of these studies is to examine and record the distribution of available trace elements in soil profiles and to find ways and means of increasing the yield of wheat, paddy and cotton under normal irrigation and drought conditions by maintaining the requisite levels of these trace elements.

The results achieved would assist in increasing the productivity of wheat, rice and cotton in the Sind Region.

S-KU/BIO (47):

Title: Culturing of micro-algae strains to produce animal feeds for commercial exploitation:

Protein deficiency has become one of the most serious problems of the world. This is more acute in developing countries where agricultural output cannot cope with rapidly increasing human populations. The result is widespread malnutrition and under nutrition to fill protein gap, world scientists are actively engaged in producing proteins from unconventional sources. Among various sources that are being investigated are plant and leaf protein and proteins from bacteria and

micro-algae. Recent review of literature has shown that Spirulina, one of the blue green algae serves as a major source of protein for the natives around lake chad (Mexico).

The proposed studies aim at the screening of micro-algae inhabiting our lakes, rivers and soils and obtaining them in unialgal and axemic culture. Subsequently studies on their growth, characteristics, chemistry of proteins, amino-acids, lysine content, nucleic acids, lipids, minerals and vitamin contents will be undertaken. The proteins extracted from these cultures will be tested for their digestibility, protein score and nutritional value. Later on attempts will be made to grow the algal strains on mass scale so that they can be exploited commercially and provide an additional source of protein for human and animal consumption at less cost.

P/BIO (56):

Title: Bibliography of fresh water food fishes of Pakistan:

No bibliography has till now been prepared on fresh-water food fishes and fisheries of Pakistan, with the result that research is repeated on problems on which work has already been done previously in the country.

The project aims at consulting the literature on all aspects of fresh-water fishes and fisheries of the sub-continent and prepare an upto-date annotated bibliography of food fishes of Pakistan. This would help in avoiding unnecessary duplication of research efforts and provide the requisite background information for conducting research along more profitable lines.

S-SU/BIO (57):

Title: Establishment of centre for 'the Culture Collection of Algae of Pakistan at Sind University, Jamshoro:

The cultivation of algae has shown rapid progress in the last three decades due to increasing awareness of their usefulness as food for animals, source of proteins, nitrogen fixer, and causing water blooms in lakes and ponds. Realizing the need and economic importance of algae, many countries have established their own centres for isolation and cultivation of pure culture (USA - at Botany Department, Indiana University; U.K. - at Cambridge University, Czechoslavakia - at Charles University, Prague and U.S.S.R. Institute of Microbiology, Moscow).

The scheme aims at establishing a Centre for the culture collection of algae of Pakistan at the Sind University, Jamshoro.

This centre, when established will not only save foreign exchange on importing the algal strains, but will also meet the needs of all the institutions engaged in research on the subject in the country.

C-IU/BIO(61):

Title: Studies on glycoprotein hormones: (a) bio-chemical, bio-physical and immuno-biological characterization of gonadotrophins and their sub-units, (b) mechanism of action of luteinizing Hormone (LH) and lutrotrophic hormone (LtH).

Glycoprotein hormones are synthesized in the cell of interior pituitary glands of mammals. The study of these hormones is usually undertaken with a view to understanding the physiological phenomena in animals of veterinary importance as well as in human being.

The object of this study is to obtain in a selectively pure form well characterized glycoprotein hormones for use in medicines and biology with the possibility of commercial preparation. Attempts will also be made to study the mechanism of action of luteinizing hormone (LH) and lutrotrophic hormone (Lth) in their target tissues to find out the genetic regulation dependent upon hormonal activation of the target cells.

The studies would provide a broad base of knowledge needed to solve the most pressing problem of human population planning and reproductive inefficiency in livestock.

C-IU/BIO (62):

Title: Studies on the mechanism of synthesis, release and regulation of human chorionic gonadotrophin (HCG) in syncitiotrophoblast cells of placenta, characterization of RNA, polyribosomal complex and other factors involved:

Syncitiotrophoblast cells of the placenta are the site of synthesis for human chorionic gonadotrophin. This hormone seems to play an important role in the maintenance of pregnancy and corpus luteum in human beings and monkeys. The mechanism that regulates the synthesis of HCG is not properly understood.

In view of the important role played by gonadotrophin hormone in human physiology, it is proposed to investigate the characterization of messenger RNA and polyribosomal complex from the placental syncitiotrophoblast. This would provide basic information on an important aspect of human reproductive physiology.

S-KU/CHEM (18)

Title: Biochemical studies on plants infected by parasitic nemotodes:

Sind region produces important tropical and sub-tropical cash crops, cereals, fruits and vegetables. Enormous losses to most of these crops are generally attributed to the plant parasitic nematodes. This study aims at exploring chemical and biochemical environments in which the nematodes are likely to attach plant roots and cause damage to the crops. Detailed studies on biochemical aspects of soil, plant roots and nematodes would provide the requisite information for adopting effective control measures.

3. CHEMICAL SCIENCES:

S-KU/CHEM (7):

Title: New calorimetric technique and measurement of heat mixing of organic liquids:

The principles of thermodynamics are used by engineers in designing the internal combustion engines, refrigeration and air-conditioning systems, and land vehicles. The flow of heat and high speed flow of liquids requires a knowledge of thermodynamic principles for their full understanding.

The proposed project involves studies on heat volume effects in physical and chemical processes to understand the nature and extent of these reactions. Since the energy changes in chemical reactions are determined by using advanced calorimeters, it can be assured that the nature of complexes formed in chemical reactions could be studied by the measurement of heat and volume change.

The economic aspects of this project can be realised by the fact that in the construction of chemical plants, heat and volume changes of reaction would be estimated before hand on a small scale as in some chemical reactions the heat and volume changes are so big that they cause explosions. Knowledge of thermodynamic functions would also help to understand the state of gases, liquids and solids.

S-KU/CHEM(10):

Title: Structural and svnthetic studies in some Carboline bases:

Medicinal plants like "harmal" (Peganum harmala) grow in great abundance in Pakistan. P. harmala contains about 5 to 7 % total alkalides in its seeds, for which no commercial use has been found as yet.

The project aims at the structural and synthetic studies on B-Carboline bases for developing new therapeutic agents for

the treatment of cardio-vascular diseases and psycho-active drugs which could be used in the treatment of certain types of mental ailments.

The proposed studies are likely to lead to the discovery of new therapeutic agents for the treatment of various diseases.

S-SU/CHEM (13):

Title: Chemical Investigations on the plant meterials of Sind:

The province of Sind is very rich in medicinal and other plants. Survey of the literature conducted shows that there are at least 200 plants in this region, which are being used to cure various diseases. No chemical or pharmacological research worth the name has so far been done on these plants.

The proposed studies envisage to isolate biologically active and chemically new compounds from the medicinal plants of this region and to investigate their pharmacological properties.

The results of these studies would help in maximizing the medicinal utilization of native herbs.

S-KU/CHEM(26):

Title: Interaction of amino acids with riboflavin and its neuro-chemical applications.

Brain is the site of several bio-chemical activities. The object of the proposed investigation is to study the interaction of riboflavin with amino acids for obtaining biological data such as free energy, entropy and stability constant, for understanding various processes at the level of central nervous system.

The results of this research would help biochemists and psychiatrists to interpret chemical stimulus, electrical excitation and propagation of the membrane proteins of nervous system with respect to reception of information, storage and memory in the macromolecules of the nervous system.

S-CSIR/CHEM(40)

Title: Effects of germination on the nutritive value and digestibility of proteins and carbohydrates of gram and Pea.

In Pakistan, large sections of the population depend on a basic diet which is low in animal protein; the protein

of their diet being mostly derived from cereals. The various types of food products made from cereals lack in some essential amino acids vitally needed in balanced diet. For example lysine and tryptophane are partially lacking in the daily diet of consumers of these products.

The nutritive value of ordinary flour can be improved by fortification with lysine, tryptophane and other essential amino acids. This can also be achieved by the addition of gram as pea flour to wheat flour to increase the protein contents as well as improve the quality of flour.

Although fortification of wheat flour with gram flour and protein has been tried in various countries, the nutritive value of germinated gram seed flour has not been studied so far.

The aim of the project is to: (1) isolate protein and carbohydrate fractions of gram and pea and study their structural characteristics, (2) study the effect of germination on nutritive value and digestibility of carbohydrates and proteins of gram and peas, (3) compare the nutritional properties of germinated and ungerminated gram and pea flour alone and admixed with wheat and corn.

These studies would provide information regarding the nutritive value of proteins and carbohydrates of grams and pea which constitute important items of our diet and possess high nutritive value.

C-IU/CHEM(41):

Title: Infra-red studies of organic compounds:

The project aims at initiating research in the field of infra-red spectroscopy leading to the establishment of a fulfledged spectroscopic laboratory in the university of Islamabad. These studies, in addition to training manpower for the spectroscopical studies, will also help to understand the basic phenomena in physical and organic Chemistry.

P-CSIR/CHEM(49):

Title: Production of single cell proteins from industrial wastes:

Proteins are essential for all biological processes, which sustain life. The gap in the demand and supply of proteins has widened with the present population explosion all the world over. In addition to conventional sources of proteins, attention is also being given to the biochemical synthesis of proteinous substances. Recently single-cell proteins produced by the culture of yeasts and bacteria on various non-edible carbohydrates and hydrocarbons have attracted attention as non-conventional source of protein to avert the impending protein crisis.

The project envisages production of single cell proteins on pilot plant scale by using the cultures of yeast and the study of the economic feasibility of the process. To ensure higher growth rates and improved yields, attempts will be made to isolate some new microbial cultures besides those already available

The study would help in providing an additional source of protein to meet the acute shortage of protein particularly in animals.

P-CISR/CHEM(51)

Title: Use of activated clay for prevention of infestation in stored cereal grains.

Infestation of food grains with weevils and other pests results in about 15-20% loss after the crop is harvested and stored for distribution. Chemical insecticides imported to overcome this problem, cost foreign exchange and their use may be potentially hazardous for human life. Attempts are, therefore, being made to adopt biological control of undesirable pests and replacement of chemical insecticides with harmless ones.

The object of these investigations is to utilize indigenous materials for the production of activated clay and devise suitable methods for their application to prevent the infestation in stored food grains.

The results of these investigations would help the various agencies responsible for storage of food grains in bulk. It would also help the health hazard due to indiscriminate use of pesticides.

4. EARTH SCIENCES:

S-KU/EARTH (4):

Title: Terrain analysis and its application to urbanization:

There is an urgent need for terrain analysis of the greater Karachi area in the wake of the phenomenal growth of population in this area. Karachi has a population of nearly 4 million which is increasing annually at an alarming rate due to rural migration. Urbanization at such a pace has produced many socio-economic problems and limitations. It is, therefore, essential that for future planning, the terrain analysis of the area must be taken into consideration.

The project envisages an integrated study of the geology, hydrology, geomorphology and soils in the greater Karachi area with a view to evaluate its potential state for better urbanization and future planning of optimum use. Investigations will also be undertaken on the natural hazards, sheet flooding, land slides, soli-fluxion, coastal innundation, wind erosion etc. The areas of

potential hazard will be delineated and suggestions made for their minimization.

This study will provide the basic inventory of land forms, soil types and hydrology and the correspondence among them. The correspondence determines the stability of the natural environment which is affected by all efforts at urbanization. The findings from this study will form the basis for the optimum and most efficient utilization of the terrain and for maintaining equilibrium between man-made environment and the natural ecosystems. The results of the study will also serve as a model for urbanization in other parts of Pakistan particularly for agrovilles in the Integrated Rural Development Programme.

S-SU/EARTH (5):

Title: Exploration and evaluation of the economic mineral potentials and deposits of Nagar Parkar, South Eastern.

Nagar Parkar area forms geologically, the south-western-most part of the Indian shield region-areas which are well known the world over as matallogenic provinces. Igneous complex (granits: diorite, syenites volcanics) of Nagar Parker is of great importance in the sense that in the western Rajisthan (India) in a similar types of rocks, a number of valuable economic mineral deposits including the ores of copper, lead, zinc, nickel, cobalt, molybdenum have been discovered; phosphate deposits have also been reported recently from that area.

The project aims at exploring the Nagar Parker Igneous complex area for metallic (copper, molybdenum, strontium or ores of copper, lead, zinc, gold) and non metallic deposits of economic importance. A geological map of the Nagar Parker will be prepared, the rocks will be identified and classified. The huge deposits of fresh granites of the china-clay already present would be properly evaluated. An effort will be made to explore the possibility of commercial exploitation of minerals of economic importance.

The results so achieved will provide an indigenous base for the industrial development of Sind Region.

F-PU/EARTH (15):

Title: Land Forms and Soil Parent material of the Khattak foot hills, Peshawar Valley:

The Khattak foot hills lie south of the river Kabul, in the valley of Peshawar and cover an area of 150 sq. miles. The soils are generally stony and infertile. Previously this area was covered with forests and grasses, but gradual extermination of trees and overgrazing of grasslands deprived the people of their only source of living. Hence people are moving to adjacent lowlands creating problems of housing and employment.

The main objective of the project is to explore the land resources and to identify soils for various types of uses, e.g., agriculture, forestry, etc. to study genesis as well as evaluation of landforms, the shape, lithology, composition, age and distribution of major surface deposits of the Khattak hills. The influence of the surface deposits on the development of soils, will also be evaluated.

The study of land-forms, soil parent material will provide basic information, which would be used for a broad apparaisal of the location, extent and characteristics of the agricultural resources

5. ENGINEERING SCIENCES:

P-EU/ENG (7):

Title: Design and manufacture of hydraulic turbines in Pakistan.

Recent fuel crisis in the world has brought into focus the need for full exploration of alternate sources of energy. Fortunately, in Pakistan, there is great potential for hydraulic power resources, which is an inexhaustable source of energy. To harness this energy and convert it into electrical energy only hydraulic turbines are required. Such turbines could be manufactured locally and possibly could serve as replacement for big generating plants which cost us huge foreign exchange.

This project aims at designing and manufacturing an impulse turbine with the help of existing local industry. These turbines, after exhaustive testing, would be installed as models at few places.

The successful completion of this project would help in laying the foundations of water power engineering industry, making the country self-reliant in small power generating plants and bringing new life in the rural areas by providing electricity.

6. MATHEMATICS AND COMPUTING ACTIVITIES:

C-IU/MATH (6):

Title: Upgrading of Computer Centre Facilities:

The IBM System/360 Computer, model 44F, installed at the University of Islamabad in 1972 caters for the needs of Government departments, educational institutions and other organizations. It is at present not fully equipped to handle all the tasks required. In order to meet the increasing demand of handling and processing large volumes of data, additional equipment in the form of full tape facility, a large core storage (memory), a Pettee data entry and computer system are badly needed. The project aims at providing additional facilities by upgrading the computer configuration to have better input/output.

The proposed upgradation of the Centre facilities handling such data computations as were not possible before i.e. enhanced storage capacity would result in handling larger volume of data and also improve its level of efficiency.

7. MEDICAL SCIENCES:

F-KMC/MED (8):

Title: Hypoglycaemic and pharmacological studies on indigenous antidiabetic plants.

Pakistan has an enormous amount of vegetable wealth in the form of medicinal plants. Hardly 2% of these have been, however, investigated for their medicinal and pharmacological properties. A number of plant products have been used in the indigenous systems of medicine to cure or relieve diabetes and some of these plants are stated to give excellent results in the treatment of this disease. Such drugs unfortunately lack scientific explanation and support. If these drugs are investigated scientifically and found really effective, a new horizon in the field of antidiabetics is likely to open.

The project envisages preliminary studies to ascertain the hypoglycaemic effects of extract of indigenous plants known to have anti-diabetic value. The active constituent will be isolated, purified and identified and its action on Allexan induced diabetic animals will be studied. Finally clinical trials of the active principal will be made.

If the results obtained are equal or better than the existing synthetic oral antidiabetics, and the active ingredient has lessor toxicity (as natural drugs are comparatively less toxic), the manufacture of such drugs will be taken in hand. Besides providing a cheaper way of treatment for our people it will help stop import of synthetic preparations which cost us an enormous amount of foreign exchange.

P-MH/MED(19)

Title: Bacteriological studies of Tuberculosis:

Tuberculosis still remains as important communicable disease in Pakistan. Research on this disease, has, however, been much neglected and very few studies made on bacteriological and some other important aspects of the disease in the country.

This project aims at studying: (i) drug resistance in T.B. patients, (ii) incidence of a typical mycobacterial infections, (iii) correlation of pulmonary and extrapulmonary tuberculosis, (iv) incidence of tuberculosis in cattle and general hygienic conditions of milk and meat consumed in a given area and (v) tuberculin hypersensitivity against typical and a typical mycobacteria in healthy population.

The results will not only help in defining the role of Mycobacteria in extra-pulmonary disease, but also in understanding the immune mechanism of this disease since injudicious use of chemotherapeutic agents has made the mycobacterial strains resistant to anti T.B. drugs.

S-JMPC/MED (21):

Title: Effect of protein-caloric malnutrition and anaemia in young children on their immune responses.

Observations over many years have suggested that there is a physiological correlation between nutritional deficiencies and resistance to infections. Studies on the interaction of malnutrition and the immune response carried out with a variety of experimental designs by numerous investigators have led to conflicting conclusions.

This study will determine the delayed hyper-sensitivity and anti-body response to sele-cted antigens in malnourished and anaemic pre-school children. The changes in immune response after recovery from the nutritional deficiency will also be measured.

The information so gathered will help in improving the nutritional status of the vulnerable pre-school children and pregnant and lactating mothers.

S-JPMC/MED (22)

Title: Epidemiological study of viral hepatitis (icteric and anicteric) in the industrial population of Karachi:

Viral Hepatitis is endemic in Pakistan. Its parentral, faecal, oral and experimental enetric transmission have been well established. All such modes of transmission are more likely to occur in communities close to industrial areas where the pattern of environmental exposure is similar for the whole group to be selected for this study. But the extent of acute and chronic icteric and anicteric disease on the health and output of industrial workers is not known.

The scheme envisages the study of the prevelence and the clinical pattern of viral hepatitis and anicteric liver disease in among the industrial workers.

The study will help to raise the health standards of the workers in the industrial areas of the country and improve their efficiency of work.

C-NHL/MED (24):

Title: Virological, serological and electron microscopic studies on hepatitis in Rawalpindi and Islamabad area.

This project is an extension of the study on the epidemiology of hepatitis.

The project envisages a study of specimens of blood, stools and liver biopsy obtained from the patients of viral hepatitis admitted in hospitals, health centres and outdoor clinics in urban and rural populations of Rawalpindi/Islamabad areas. Virological, serological and electron microscope studies would be undertaken at different stages of disease. Similar data will be collected from organized community groups including blood donors.

C-NHL/MED (25):

Title: Role of arthropode borne viruses in human diseases in Pakistan:

Preliminary studies made on 207 blood samples have yielded two strains of west-line virus and three strains of group A and B viruses. This establishes a need for further studies concerning the role of arthropode borne viruses in human disease in Pakistan.

This project aims at studying the central nervous system viral diseases like encephalitis, encephlomyelitis and meningitis transmitted through the arthropode vectors such as mosquitoes, ticks and sand fly (Phelobotomus). Attempts would be made to develop vaccine(s) against these diseases.

These studies will help in controlling viral diseases spread by the arthropode vectors and if possible lead to the development of vaccine(s) for the prevention and control of arthropode borne viruses.

C/NHL/MED (26):

Title: A study on streptococcal infection, rheumatic fever and rheumatic heart disease in Rawalpindi/Islamabad areas:

Streptococcal throat infection is quite prevalent in urban areas and crowded communities. Group A streptococcal infection is hazardous as it may lead to such serious consequences as heart disease. It is, therefore, necessary that the prevalence of this infection and its sequelae should be studied systematically.

These studies aim at surveying the rate of group A streptococcal infection and its relationship with rheumatic fever and rheumatic heart disease in organized communities like schools, colleges and other institutions.

The results would help in evolving preventive measures against the streptococcal infection in urban areas and crowded communities.

8. PHYSICAL SCIENCES:

S-KU/PHY (5):

Title: Fundamental and Applied Research in Experimental Solid State Physics at and below room temperature:

The intrinsic behaviour of solids cannot be studied at and above room temperatures because of the domination of other properties by lattic vibrations of a crystal. Moreover, the nature of crystal defect, its source and mechanism of its migration can be explored only at low temperatures. The Karachi University has developed some facilities for under-taking low temperature physics studies, and work on using this technique is in progress. It is necessary to augment the facilities and expand the scope of studies. The proposed investigations aim at the study of: (i) the measurement of resistances and, (ii) mechanical and elastic properties of some solids. Reliable and comprehensive data on the elastic module, elastic co-efficients tensile strength, creep and fatigue properties and hardness are of great importance for studying defect structures and defect mechanism responsible for mechanical behaviour.

The results of this project, apart from its purely scientific merit, would create a nucleus of scientific workers capable of taking up the challenge of technological developments in cryogenic engineering as well as in building a good low temperature physics laboratory in the country.

B) Integrated Research Programmes:

In addition to responding to the initiative of the scientists, the Foundation has endeavoured to promote coordinated programmes in areas which have a direct bearing on the achievement of national goals. The Goals and Priority Committee of the Foundation assisted by its technical committees and the advisory and expert panels of the Foundation keeps under constant review lists of such programmes, and also the advice received from various agencies in government and industry, in particular the National Science Council and the Planning Commission.

It is obvious that the integrated programmes take considerable preparation to launch, as they involve inter-institutional and inter-disciplinary collaboration, as well as considerable cost. In view of the limited financial resources, at present available with the Foundation, it is also not possible to undertake the financial burden involved in launching a large number of such programmes. The emphasis is on the development of a few model programmes. The role of the Foundation is mainly that of a catalyst for developing schemes, stimulating interagency collaboration and in obtaining support from government and aid-giving agencies. Some of the co-ordinated programmes initiated by the Foundation during the current year are as follows:-

a) A proposal for coordinated research programme in the field of medicinal plants has already

been circulated to the scientists/institutions concerned with a view to invite research proposals. According to this programme research would be undertaken in the various establishments in the country where interested and trained scientific workers are available and where facilities for such work exist.

The project includes studies on:-

The preparation of a comprehensive list of medicinal plant resources and the determination of their active principles.

Develop a Genetic Bank for authenticated medicinal plants at a suitable research establishment with an information centre and demonstration garden for cultivation research and for public enlightenment.

Initiate a cooperative investigation into the pharmacological effects of crude extracts and isolated constituents of the known, authenticated medicinal plants at an annual rate of about 50 species per year.

Initiate a discovery programme for the sampling of a minimum of 24 non-medicinal plants of Pakistan per year collected randomly from the forests and field and subjected to extraction and pharmacological screening. If found significantly active, isolation procedures to be initiated to identify the active chemical components and evaluate them for animal and eventually human therapeutic application.

Develop a continuing supply of well qualified talent for long term continuation of the project in medicinal chemistry, pharmacognosy, pharmacology, taxonomy, agronomy, hydrology and phiscal management.

Because of the broad inter-disciplinary nature of this project and its likely benefits to the scientific economic and social systems, a high level committee is being constituted, which would act as the Expert Advisory Committee of this project.

(b) Plans are being advanced to undertake coordinated programmes in the field of arid-environment studies with the University of Punjab and other governmental and non-governmental organizations in the country.

(c) Institutional Support:

Quick, efficient and modern analytical techniques demand the use of a variety of sophisticated equipment and a scientific worker is greatly dependent for the precision and speed of his research on the equipment and tools available to him at a research institution. The availability of appropriate equipment enables the scientific workers to be more productive as well as makes possible such investigations which would not be possible without specialised equipment and tools. In view of the paucity of resources it is obvious that PSF cannot equip every research establishment with all types of costly equipment. Selective upgrading of such centres in the nation which already have a nucleus of sophisticated analytical facilities through additional funding to create 'National Centers' in the more important fields, where scientific workers from other universities and research institutions could also come for work, is one aim of PSF institutional support.

The Pakistan Science Foundation also assists in the provision of equipment and chemicals, etc., to research workers, who for some reason are unable to get these from their own institutions and it is established that such support would lead to quick progress of research of national significance.

The emphasis is on (i) fostering and equipping multi-disciplinary research units directed towards the solution of areas of high research priority; (ii) provision of equipment, literature, staff training facilities and improvement of data processing, documentation and information systems and similar facilities which would build up research capability of selected research centers and units.

Some of the grants sanctioned during the current year, to enhance the institutional capabilities, are as follows:-

(i) A grant of Rs. 4,00,000/- has been sanctioned as special financial support to the University of Islamabad for upgrading its computer centre facilities. Out of the sanctioned grant, an amount of Rs. 1,00,000/- has already been advanced to the University for the 1st phase of computer centre expansion programme.

(ii) The Foundation has also sanctioned two research projects in the Department of Biological Science, University of Islamabad for setting up a biochemical unit. The establishment of such a unit would not only ensure the continuity of research in

biochemical and related aspects but would also help in producing the scientific manpower in this area of high priority research. This unit may later be expanded to an Institute of Biochemistry.

(iii) Another project has been sanctioned to the Karachi University for the enrichment of its Invertebrate reference Museum which will provide reference facilities not only to the biologists in the country but also to the foreign scientists interested in the fauna of the North Arabian Sea.

(d) Participation in regional and inter-national programmes:

Research programmes specially identified as major research efforts, are undertaken by the international community, at regional as well as global levels, to accomplish designated objective related to one or more fields of science or to achieve a defined economic or social goal. The Foundation has been engaged in identifying such programmes and is endeavouring to arrange for the participation of the Pakistani Scientists.

There are now a number of international and regional research centres established by the United Nations family of specialized agencies or others including private and National Foundations. Linkage with such organization makes available valuable external research resources.

At the International level, Pakistan Science Foundation is participating in the UNESCO sopnsored 'Man and Biosphere programme. PSF has also established links for collaborative research programmes with organizations such as NSF (National Science Foundation) and EPA (Environment Protection Agency) of USA. Ten research proposals for collaborative research have already been submitted to the Scientific and Technological Research Division for onward transmission to the National Science Foundation of USA through the Embassy of United States in Pakistan.

At the regional level also linkage is being established with national research organizations in other countries for the exchange of information, experience and material.

III. UTILIZATION OF RESEARCH RESULTS.

Title: The utilization of the results of scientific and technological research, including pilot pland studies, to provide the technical and economic feasibility of processes found to be promising on laboratory scale.

The most pressing problem of Pakistan is to equalise technological levels with the contemporary world. Except in the tiny modern sector, the prevailing technology is traditional and low in productivity. Effective utilization of the results of research from world as well as indigenous sources, technology transfer and its widespread application, is dependent upon the adequacy of institutions, mechanisms and programmes aimed at this specific purpose. The Pakistan Science Foundation has the responsibility to provide this infra-structure through the proposed Centre for Research Utilization and Special Project (CRUSP). A project for the purpose has been submitted to the Government.

Pending the implementation of CRUSP, special attention was given by the Foundation to develop projects for the utilization of results of research in the following two high priority areas:-

i) Increased production of Meat and Milk through grain revolution.

ii) Development of appropriate Technologies.

i) Increased production through a coarse-grain revolution.

As reported earlier a number of factors basic to the development of livestock industries were identified by the Foundation and it was found that the most serious constraint is the non-availability of enough coarse grains which constitute an essential component of poultry and livestock fatting rations. In the face of serious food shortage for human beings, coarse grains could be the saving factor for the nation. Accordingly programmes were developed by the Foundation to utilise the results of research in respect of coarse grain production which will provide an additional 2 to 5 million tons of grain sorghum from lands at present left fallow in; (a) cotton wheat rotation in irrigated tracts, (b) after the harvesting of rice mainly using residual moisture in soil and (c) by improved agricultural practices in the areas currently under grain sorghum cultivation. The programme was given practical shape by launching a pilot project in collaboration with M/s. Rafhan Maize Products and the first phase of programme was successfully completed in June, 1974.

The second phase of the project was undertaken in Summer 1974. Thirteen new varieties including those imported from Australia and USA were tried. Out of the varieties tested in spring season (1974) Pacific 007 and

N K 222 were retained. A local variety namely SS2 was also included. Sowing was started on 15th August and completed on 28th August, 1974. In most of the cases the crop matured before 15th December with one or two irrigations after germination, thereby enabling the farmers to plant their wheat crop in time. In Larkana district where sub-soil water levels were high, crop matured without any irrigation. Duration and average yield obtained from different varieties of grain sorghum tested during summer of 1974 indicated that the Australian variety Pacific 007 maintained its superiority over all other varieties under trial during the summer as well. Next best variety tested during the summer was N.K. 222 USA, but it took a week more to mature. Most of the foreign varieties were short in stature and were very much liked by the farmers as these facilitated watch and ward against the bird damage.

The third phase of the project is under implementation, wherein other high yielding varieties with still shorter duration such as Mimimalo, Swana etc., are being tried. Some of these varieties are claimed to be bird repellent as their grains are somewhat bitter to taste when un-ripe. The results of these trials would be available after the crop harvesting in June.

As a result of successful experimentation in the Ist and 2nd phase of the hybrid variety of grain sorghum Pacific 007, another supplementary project entitled, "Plantation of grain sorghum hybrid , on the lands of small farmers, on the residual moisture in the fields after removal of rice", was sanctioned by the Foundation. The project envisages cultivation of the variety on the lands of a number of farmers during the spring of 1975 to test its performance on the peasants' land. The experiments are being conducted on about 250 acres of land between Mohenjodaro and Larkana. The preliminary reports of these trials are very encouraging and it is expected that the farmers would continue large scale production, of grain sorghum, after this demonstration (Pls 3 and 4).

The question of producing the hybrid sorghum seed Pacific 007 locally was discussed in meeting with the Minister of Education, Science & Technology and Provincial Coordination. He directe d that the parent strains of Pacific 007 should be imported forthwith and efforts made for the production of hybrid seed within the country. The Foundation has accordingly sanctioned a grant of Rs.3,00,000/- to the Directorate of Livestock Farms, Punjab for the import of Patent stock of hybrid 007 from USA and the experimental production of the seed of Pacific 007, in collaboration with Dr. A.G. Bhatti, who piloted the main project. The parent seed and the hybrid seeds would thereafter be supplied to all the provinces for making their own arrangements to propogate the variety extensively.

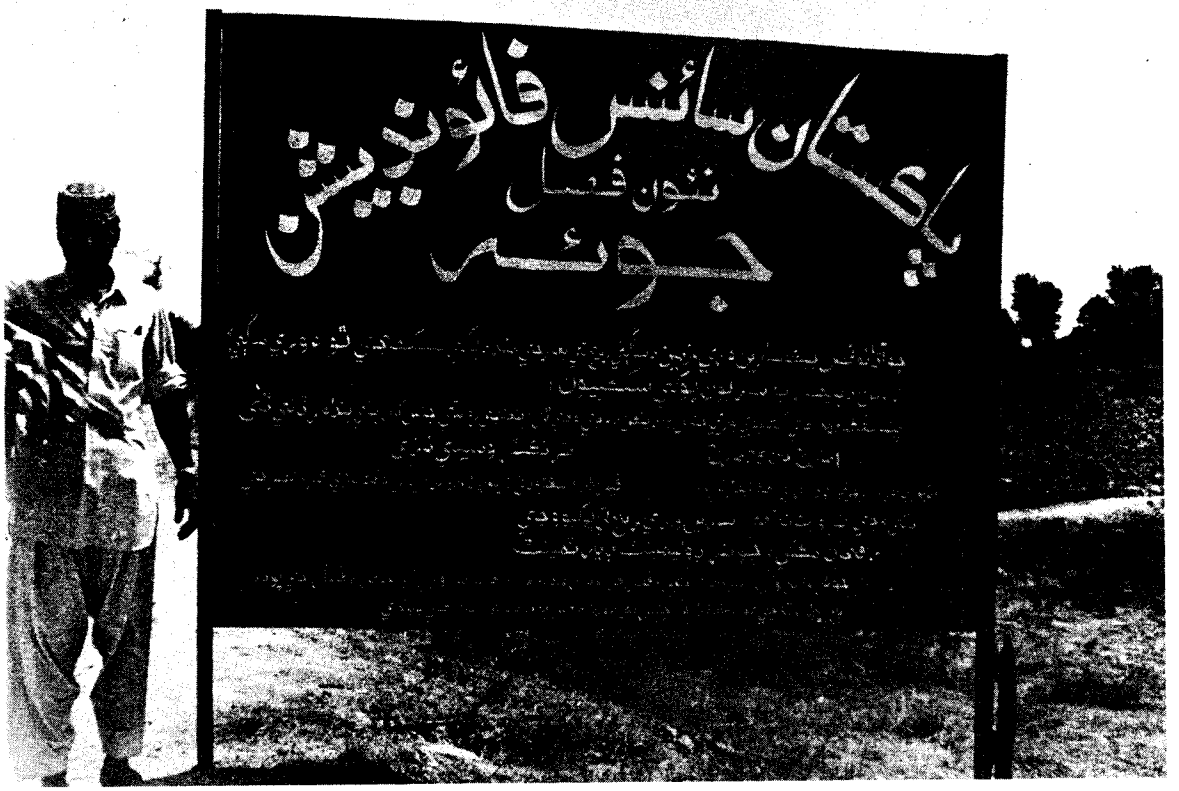


Plate No. 3&4 Sorghum grown as additional crop on the fallow lands in Sind.

ii) Development of appropriate Technologies:

The pattern of technological and industrial development followed so far in Pakistan has been a simple transfer of western technologies which is capital intensive, labour saving, dependent on imported machinery and even raw materials. It has exclusively benefitted the small modern sector depriving the rural masses from participation and benefitting from the process of modernization and social reconstruction. Special efforts, therefore, were made by the Pakistan Science Foundation to promote and evolve intermediate technologies so that the mass of the people could benefit.

Some of the areas identified preliminarily in which such technologies would be promoted are:-

i) ENERGY: Non-conventional sources, such as, bio-gas, as well as, small hydro-electric projects and solar energy.

ii) WATER: Harvesting and conservation of rain-water, creation of small reservoirs, low-lift pumps, desalination of water through solar energy.

iii) FOOD AND AGRICULTURE:

(a) Storage, preservation and dehydration of foods, fortified wheat flour and 'Nan', development of processes livestock feed.

(b) Fish curing.

(c) Improved agriculture and animal husbandry practices, machinery and implements suited to small farms.

iv) WORKS:

(a) Building construction, utilization of mud and lime, and redesigning of houses for comfortable living conditions in terms of temperature and humidity, appropriate to each area. Improved precast material, bricks and brick kilns and provision of lime kilns etc.

(b) Soil stabilized village roads, and culverts, constructed from materials available locally.

(c) Health and sanitation: Safe drinking water supplies, village drainage, sewerage disposal and other connected facilities.

v) INDUSTRIAL CHEMICALS:

Manufacture of chemicals and products from agricultural wastes, such as, rice husk, wheat straw, banana pulp and fibre, fertilizer and insecticide plants, setting up of mini-plants and local leather industry.

Cooperative projects developed with various universities/ research organizations to ensure the establishment of appropriate technologies in some of the high priority areas are mentioned in the following paragraphs:

BIOGAS

The energy needs of rural areas of Pakistan are being met largely by non-commercial energy resources such as animal dung, wood, charcoal, farm-waste and kerosine oil. Kerosine oil is becoming increasingly expensive the world over. The burning of animal dung is very wasteful. It should be returned to soil to improve farm productivity. It is estimated that from 10-25% of animal dung is burnt for cooking purposes in the irrigated areas while in the rain-fed areas the rate of consumption of dung for fuel is much higher. In areas where wood is burnt for fuel, trees are being felled very rapidly and the consequencies are evident in the high rate of soil erosion which eventually removes the topsoil and takes land out of productive use.

Recognizing the need for enhancing the rural energy supply base and to supplement the efforts of the Government with regard to the Rural Works Programme aimed at the amelioration of socio-economic conditions in the rural areas, possibilities were explored to meet the rural energy requirements. It became evident that through the use of bio-gas plants methane gas could be recovered from animal dung without affecting its quality as fertilizer. The Foundation, therefore, decided to utilize this source for meeting the energy requirements of the rural areas and the following projects were given to the appropriate agencies for setting up prototype bio-gas plants, suitable for local conditions.

PSF/UTZ/ERC/3(2)

Title: Prototype plant for production of Biogas:

This project envisaged the construction of a prototype Biogas plant by the Energy Resources Cell of the Ministry of Fuel, Power and Natural Resources at the Dairy Farm, Islamabad, where adequate supplies of cow-dung were readily available.

The prototype was so designed as to have a daily input of 500 pounds of cow dung and is expected to produce about 400 cubic feet of methane gas. This amount of gas collects in a 8-feet diameter tank, made from 16-gauge sheet metal. The cow dung well is about 12 feet deep; due to material balance consideration, about 500 pounds of high quality nitrogenous

fertilizer is made available for the well each day. The design of the plant is shown on page 57 whereas the technical specifications of the prototype model are given below in Table II.

TABLE II

Technical specifications of prototype biogas plant

1.	Gas tank, size	8 - feet diameter
2.	Cow dung well, depth	12 - feet
3.	Cow dung input	500 pound weight daily
4.	Fertilizer output	500 pound weight daily
5.	Amount of gas produced	About 400 cubic feet daily
6.	Gas pressure	About 3 inches of water (can be manually adjusted to six inches of water column).
7.	Methane composition	Nearly 65% of gas produced
8.	Condensate (daily)	Negligible
9.	Environmental pollution effects.	No flies or mosquitoes; no smell in affluent.
10.	Energy cost. Rs:million BTU	Rs.3.75 (Relative prices of fuels indicated in Appendix III)
11.	Pay-out period	3.5 years.
12.	Total investment	Rs: 5,000/-
13.	Life span	15 years.

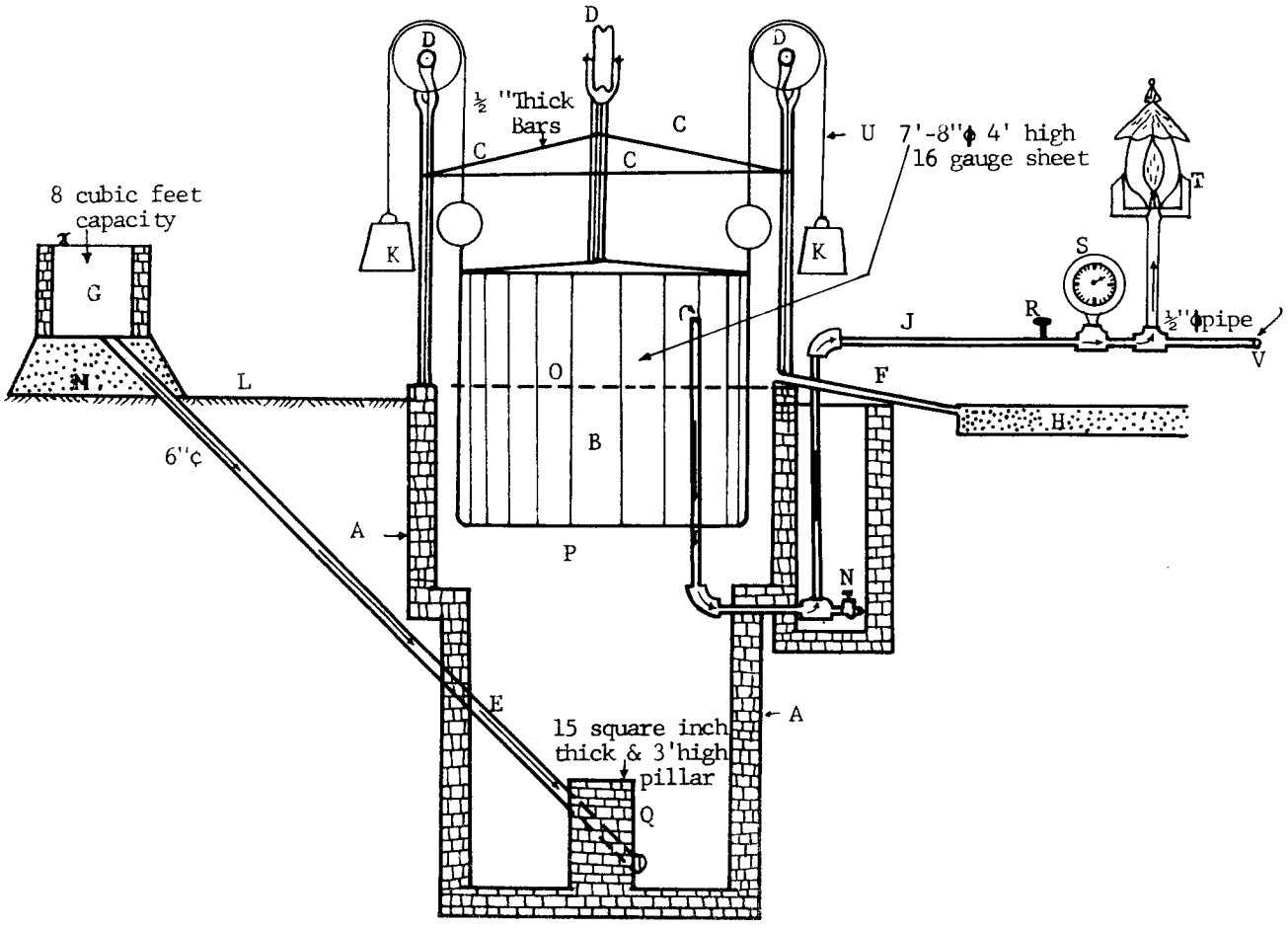
The prototype has been operative since 15th October and is presently being used for producing fuel in the kitchen and gas lighting at night.

It is further proposed to use some of the gas for poultry hatching. In addition experimental data on the effectiveness of the cow dung affluent as a source of fertilizer is being studied in a nearby farm plot.

The economic aspects of plants have been studied and it is estimated that the relative price of bio-gas based energy, is Rs:3.75 per million BTU. This is based on a capital investment of Rs:5,000/- and an annual operating cost of Rs:50/- for the duration of the life span of the plant namely 15 years.

No operational problems have been encountered so far.

DESIGN SPECIFICATIONS OF A BIO-GAS PLANT



A. BRICK LINING
B. GAS TANK, RUST PAINTED
C. IRON BARS
D. PULLEY
E. ANIMAL DUNG INLET PIPE
F. SLURRY EXIT CHANNEL
G. ANIMAL DUNG MIXING TANK
H. EFFLUENT ANIMAL DUNG PIT
J. GAS OUTLET PIPE
K. COUNTER WEIGHTS
L. GROUND LEVEL
M. EARTH PLATFORM
N. GAS MOISTURE DRAIN PLUG
O. ANIMAL DUNG SLURRY LEVEL
P. FERMENTATION WELL
Q. SUPPORT PLATFORM
R. GAS VALVE
S. PRESSURE METER
T. GAS LIGHT
U. STEEL WIRE
V. GAS PIPE TO KITCHEN

PSF/UTZ/SU/3(1)

Title: Prototype plants for production of Biogas in Sind Region:

This project envisages the setting up of ptototype units for the preparation of bio - gas in some villages of Sind to demonstrate the usefulness of the device to the villagers and local haris.

PSF/UTZ/FU/3(3)

Title: Use of Biogas for operating prototype gas engines in rural areas for pumping water:

The project envisages the utilization of bio-gas as a fuel in running an engine coupled with an electric generator for pumping water.

An average plant for gas production costs about Rs:8,000/- In case of electric supply to tube-wells the transmission lines are heavily subsidized by the government. If all the tube-well are run on bio-gas it will not only result in saving of subsidy but would also save 4,00,000 killowatts of much needed electricity per annum.

A bio-gas plant of 110 cub. ft. capacity has been commissioned in the Department of Mechanical Engineering, University of Peshawar. The gas from the plant is being used to run a 5 HP engine which is coupled with an electric generator from which one Killowatt of electricity is being utilized at present. (Plates 5 & 6).

SOLAR ENERGY:

Until recently very little effort had been directed towards the utilization of solar energy primarily because of the availability of conventional fuels. Now that the conventional fuel prices have greatly escalated, it is necessary to re-examine the economic feasibility of other sources of Energy such as Solar Energy.

Utilization of Solar Energy can be divided into the following three categories:-

i) Heliothermal: In this case the radiation is converted into heat, e.g., for distillation of water, air heating, water heating, solar furnaces, production of electricity by thermodynamic processes, thermocouples etc.

ii) Heliochemical: A specific band of solar radiation causes chemical action to sustain growth in plants and animals. Important reaction of this category is photo-synthesis.

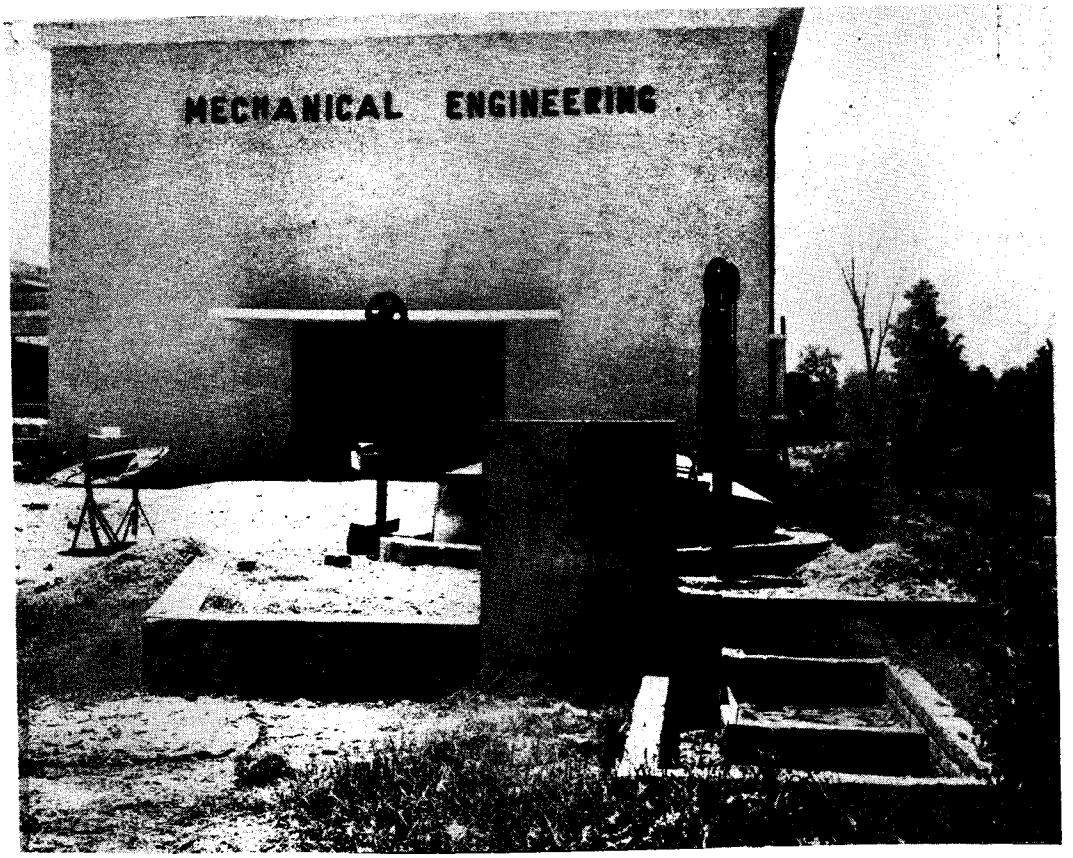


Plate No. 5 Biogas plant setup by Mechanical Engineering Department of Peshawar University.

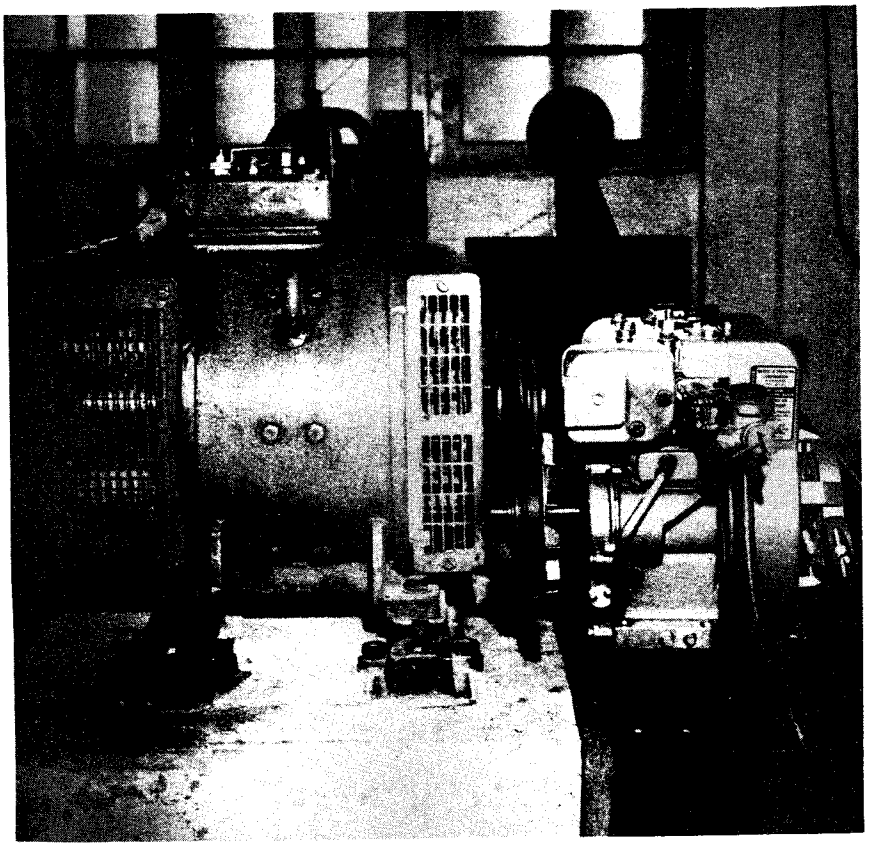


Plate No. 6 Biogas being used to run 5 HP Engine which inturn is coupled with a generator for producing electricity.

iii) Helioelectrical: Solar radiation is used to produce electricity directly, e.g. Silicon Cell - a standard power source for most space probes. Silicon cells convert solar radiation into electricity with an efficiency of about 16% while metallic thermocouples are 1% efficient and semi conductor thermocouples are 10% efficient. Terresterial use of these devices is limited because of high cost.

A large solar radiation belt exists between 40^{o} N and 40^{o} S latitude. Practically the whole of Pakistan lies in the solar belt, solar energy can be put to the following uses in Pakistan:-

1. Food cookers
2. Water heaters
3. Refrigeration
4. Air Conditioning
5. Space heating
6. Conversion to mechanical power.
7. Water distillation
8. Green houses

The Foundation has developed supported projects with the universities/research organizations for undertaking research on the utilization of Solar Energy. Outlines of the projects are given below:-

Title: Utilization of solar energy for small scale application:

The project envisages the construction of:

i) Flat plate solar heat collector: This collector, comprising of two flat plates, will be designed for 30 gallons capacity per day and will be suitable for supplying hot water at a minimum temperature of 155^{o}F. The same collector will be utilized for absorption type refrigerator of size suitable for average family.

ii) Conversion of solar energy to mechanical Power: It will involve the construction of a 12 feet diameter parabolic reflector and development of hot-air engine working on the Ericson Cycle. Such a plant will be suitable for pumping of underground water for irrigation purposes and averting salinity. There will be no running expenses.

iii) Conical feet solar reflector: This is a small reflector of about 5 feet diameter designed for about one H.P. equivalent of heat energy. This will be suitable for running a vapour turbine plant.

iv) Construction of solar air heater: This heater will use solar energy for heating and humidification of air for use in buildings.

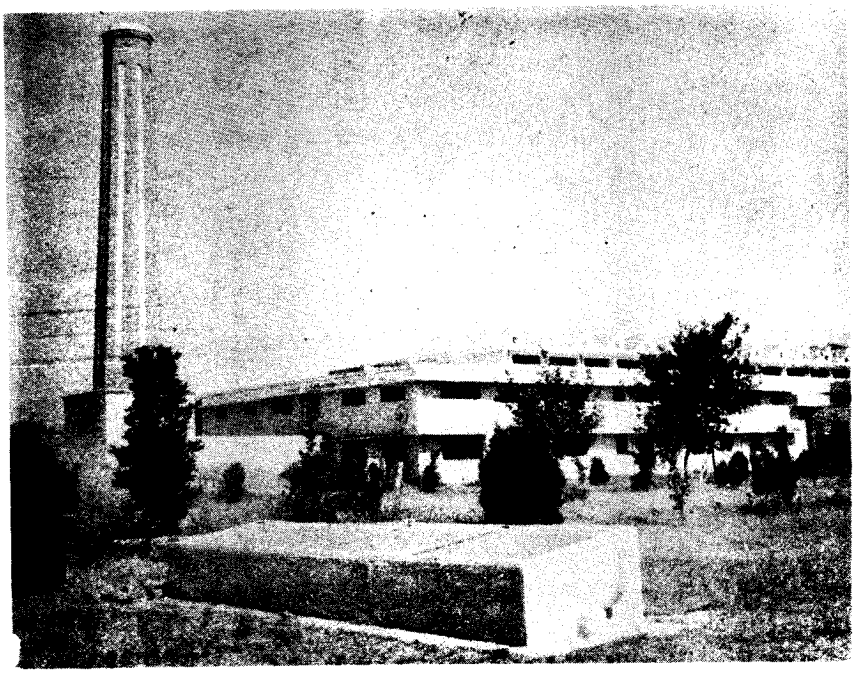


Plate No. 7&8 Solar Energy reflectors constructed by the Mechanical Engineering Department of the Peshawar University.

v) Sun tracking mechanism for 12 feet sun reflectors: This will involve use of photo electric cells to automatically aligne the reflectors with the sun during the day time. A second type of mechanism would also be developed which will use water bellows to follow the sun from East to West.

vi) Desalination of water: The project involves use of solar energy for improving quality of drinking water in rural communities.

The construction part of the above mentioned appliances has been completed (plates 7&8). These are now being tested for their functional efficiency.

HYDLE POWER

PSF/UTZ/FU/4(1):

Title: Design and construction of a prototype electric power generator utilizing water-wheels in selected areas of N.W.F.P.

In certain areas where extention of electric grid supply is not considered economically justified for reason of low population density or of terrain, the water wheels may be utilized for generating small scale electric power. A number of water-wheel installations are already in operation in certain selected rural areas of N.W.F.P., which, at present, are using imported kerosine oil for meeting their energy and lighting requirements.

The proposed project aims at studying the prospects for using the water-wheels for generating small scale electric power upto 5 kilowatts. Prototype D.C. generators will be designed and tested on site. Proper design of water wheels will also be undertaken with aview to improve their operational efficiency.

Subsequent to this project, design of commercial size water wheels and generators would be undertaken with a view to meeting electric power needs for domestic purposes in small rural communities and to effect savings by replacing the use of scarce and expensive kersone oil.

AGRICULTURAL IMPLEMENTS:

PSF/UTZ/FU/6(1):

Title: Design construction and manufacture of manual grain crop harvestor:

Wheat and other grain crops are harvested with sickle (daranti) by manual labour, or a tractor drawn mover, cutter or a combine. In the hand labour method, lot of labour is required which also affects the harvest due to weather losses. These losses are in the form of very dry grain being lost in the field while being harvested, due to high velosity winds and rain at the time of harvest.

Such losses can be reduced either by full or semi mechanization of crop harvesting. Since complete mechanization is not feasible immediately due to financial and other constraints, it would be highly desirable if semi mechanization is adopted immediately. This will provide a basis for agro-based industry products and manufacture of cheap and improved farm implements in terms of prices, maintenance costs, employment opportunities for semi-skilled persons, use of manual labour more efficiently and saving of drudgery to peasants.

The project envisages the construction of manual harvester having an efficient/economical design with a maximum production capacity for reducing grain losses in field due to inclement weather and crude harvesting methods.

The proposed equipment would not lead to unemployment as it will be moved by one or two men in the field and then the harvested crop would be collected and bound for threshing by manual labour. The major advantage would be the harvesting of crops in time and the avoidance of grain losses due to delayed harvesting.

INDUSTRIAL CHEMICALS:

PSF/UTZ/SU/3(1):

Title: Utilization of discarded banana plants for the preparation of pulp suitable for paper making:

The banana trees after fruitation have to be felled and discarded. It is estimated that in one acre of banana plantation, there are about 1000 to 1500 plants. Each green plant weights on the average about 40 lbs and each plant yields about 3 lbs of crude pulp i.e. about 5% its weight. It is, therefore, possible to get about 3600 lbs of pulp from one acre per year. It is believed that total plantation of banana in Sind is about 1800 acres which is expected to give 15 - 20,000 tons of pulp per year.

The project envisages the construction of prototype units for the production of pulp from the banana wastes suitable for paper making. These units will eventually be transferred to the villages where bananas are grown e.g. in district Thatta, Mirpur Khas, Tando Adam, Hyderabad and Miani etc. The project further envisages the transfer of this technology to the villages in such a manner as to require very little technical knowledge and sophistication. The unit will be of such a size as to turn a couple of tons of pulp per unit per year. The pulp so prepared will be directly bought by the paper factories which are grossly short of pulp in this country.

Setting up of such units would help the Haris to enter into the field of small rural industries and earn extra money from waste products, besides increasing national production.

ANIMAL HUSBANDRY:

PSF/UTZ/P-DLSF/8(1):

Title: Studies on corriedale sheep in Pakistan:

Corriedale sheep developed in Australia under climatic, environmental and managemental conditions totally different from Pakistan were imported under the auspices of the Agricultural Development Bank and distributed among the farmers.

The Directorate of Live-Stock Farms Punjab considered it advisable to maintain a flock of these sheep to study their performance under local environmental conditions. The flock thus established would also provide rams to other farmers for breeding and save further foreign exchange costs.

A project was accordingly sanctioned to study the feed and managemental needs of corriedale sheep for optimum production under prevailing conditions and their resistance to local diseases. Investigation will also be undertaken on their fertility, breeding, growth, wool yield, and twinning etc.

The study carried out under this project would assist in protecting investments of farmers of small means and would help augmenting supplies of medium wool for the local woollen industry which is importing wool tops worth over 2 crores of rupees annually in foreign exchange from foreign countries.

IV) SCIENCE CENTRES:

The establishment of science centres, clubs, museums, herbaria and planetaria:

No programme of research support can be sustained if there is not enough awareness in the population at large of the role of science in national progress. To achieve public understanding of the impact of science on society, an institutional structure needs to be created, including the establishment of science centres and the promotion of science clubs, in all communities, large and small.

Plans are being formulated for the establishment of science centres, all over the country, which will include science clubs, children museums of science and science exhibitions to make the society science conscious. Two types of science centres are proposed to be established: (1) as part of educational and scientific establishments and (ii) as independent institutions run by civic bodies, science societies, and associations. Such centres would maintain science libraries, arrange science exhibitions, science fairs, popular lectures on science, popular courses on science subjects, and promote science clubs. The universities and the provincial governments were accordingly encouraged to develop projects for the establishment of science centres. Their requests for financial and technical assistance in the establishment of such facilities when received would be considered on merit. The proposal submitted by the Board of Intermediate and Secondary Education for setting up a science centre at Lahore is under active consideration of the Foundation. The scheme for setting up of the National Science Centre at Islamabad, prepared by the Pakistan Science Foundation is also under consideration of the Government. The Foundation is developing project proposals for the establishment of Science Museums, Herbaria and Planetaria by the Fe deral Government, as both the capital cost and the expenditure for their maintenance on a continuing basis would be considerable and beyond the existing resources of the PSF. Possibilities are also being explored for foreign assistance in terms of grant and expertise.

The project for the establishment of National Herbarium in collaboration with NSF (USA) has already been initiated at the university of Islamabad whereas the proposal for the establishment of National Natural History Museum at Islamabad is being recast on PC-I for submission to the Federal Government.

V) SCIENTIFIC SOCIETIES/LEARNED BODIES:

In the technologically advanced countries scientific societies have played a major role in making society science conscious. Though a considerable number of such societies exist in Pakistan, they have faced serious financial difficulties which have hampered their effectiveness.

The Foundation is making annual grants to the established societies and endeavouring to provide all possible assistance to the new ones. Annual grants amounting to Rs. 5,28,000/- were sanctioned this year to various Scientific Societies and Learned Bodies for the achievement of their approved objectives (Annexure-IV).

Special grants totalling Rs. 82,779/- have been sanctioned to various scientific societies for their publication programmes (Annexure-V).

A grant of Rs. 15,000/- was given to the Pakistan Academy of Sciences for organizing the Ist birth centenary celebration of the famous italian physiscist Marconi. The development of the electronics industry has been woefully neglected in the country and it was felt that this would provide an ideal opportunity for focussing public attention on the importance of electronics. The celebrations included a number of scientific papers read by eminent scientists in the field of communications and electronics. An impressive exhibition of electronics and telecommunication equipment also formed part of the programme which was largely attended by the public (Pls 9 & 10). Celebrations were also supported at PCSIR Karachi and Engineering University, Lahore.

Plate No. 9 Mr. Hafeez Ullah Cheema, Minister of State for Science and Technology addressing the audience on the occasion of the 250th Centuary celebaration of Italian Physicist Marconi.

Plate No. 10 Chief guest looking at the electronic exhibits.

VI) SCIENCE CONFERENCES:

Title: The organization of periodical science conference, symposia and seminars:

Conferences, seminars and symposia serve as important means for the exchange of ideas and information amongst the scientific workers. This activity so far had been minimal mainly due to financial constraints. The Pakistan Science Foundation not only assisted in improving the functioning of existing conferences but also endeavoured to sponsor/support several seminars and symposia on problems related to socio-economic needs of the country. Grants totalling Rs. 2,15,500/- were given to various scientific societies/institutions in the country for holding seminars, symposia, conferences (Annex. VI). These included an all Pakistan Science Conference at the Agricultural University, Lyallpur, and an International conference on Water-logging and Salinity at the Engineering University, Lahore. A brief account of the seminarsis given below:-

a) A seminar on the 'Problems of the Barani Areas' was held under the auspices of the Scientific Society from 14th to 18th of March, 1975 at Lyallpur. A large number of papers were presented and there was wide ranging discussion on various aspects of the problem of Barani areas (Pl. 11).

b) A seminar on "Scientific and Technological Information co-sponsored by Pakistan Scientific and Technological Information Centre (PASTIC) and the University of Islamabad, was inaugurated by Shahzada Saeedur-Rashid Abbasi, Minister of State for Science and Technology on 9th April, 1974. Fifty participants including active scientific workers and information specialists from research establishments and university libraries from all over the country attended the seminar. The seminar was the first of its kind ever held in Pakistan (Plate 12).

c) A symposium on Human Environment jointly sponsored by Pakistan Association for the promotion of Science and Appropriate Technology (PAPSAT), the National Committee for Man and Biosphere programme, the University of Islamabad and the Pakistan Science Foundation was inaugurated by Mr. Rafi Raza, Federal Minister for Production, Industries and Town Planning on the 5th June, 1975 - the world environment day. The symposium was attended by a large audience and

Plate No. 11 Dr. Z.A. Hashmi, Chairman, Barani Commission and Dr. Israrul Haq, Vice Chancellor, Agricultural University, Lyallpur speaking at the symposium on the problems of Barani areas.

Plate No. 12 Shahzada Saeedur Rashid Abbasi, Minister of state for Science and Technology presided the 1st seminar on "Science and Technological information".

papers were presented by distinguished scientists to bring out the problems of Human Environment in Pakistan. Similar seminars were sponsored by the Foundation at other universities. The high-light of the World Environment Day in Peshawar University was an environmental exhibition organized by the regional Planning Department, Government of N.W.F.P., Pakistan Council of Scientific and Industrial Research, Peshawar, Pakistan Forest Institute, Pakistan Academy for Rural Development; Water and Soil Investigation Department, Peshawar and several departments of the Peshawar University.

Plate No. 13 Mr. Rafi Raza, Minister for Production, Industry, Environment and Urban Affairs addressing the audience at the "World Environment Day" Symposium.

Plate No. 14 Dr. Kazi Ainuddin, Professor, University of Engineering and Technology (extreem right) with Shiekh Zaki Yamani, Saudi Arabian Oil Minister. Photo taken on the occasion of IX World Energy Conference held in Detroit, U. S. A. from 23-27 September 1974. Visit of Pakistani Scientist supported by the Pakistan Science Foundation.

VII. EXCHANGE OF VISITS:

The exchange of visits of scientists and technologists with other countries:

a) A major weakness of Pakistani science is its isolation. Due to lack of contact with the scientists in advanced societies and the absence of intellectual interaction, many of our scientific workers become obsolescent and lose enthusiasms, freshness and spontaneity. In order to end the isolation of Pakistani science, grants totalling Rs. 1,70,972/- were given to 13 scientists to enable them to visit international conferences, seminars and symposia (Annexure - VII).

b) The Foundation also sanctioned a grant of Rs. one thousand per month for the period from 6th Sept 1974 to 30th June 1975 to Professor Masood Ghaznavi as visiting professor from abroad to the University of Islamabad thereby giving an opportunity to our teachers and scientists to share his experience and exchange the latest scientific information in the field of his study.

c) The Pakistan Science Foundation also organized and financed the visit to Pakistan of the 7-members Chinese Scientists Delegation comprising of eminent scientific workers of the Chinese Academy of Sciences as per list given below: from 9th to 29th December, 1974 (Plate 15 & 16):

1. Mr. Kuo Pei-Shan,
Chairman,
Revolutionary Committee,
Institute of Physics,
Chinese Academy of Sciences (CAS).

2. Madam Li Chih-fen,
Head of Synthesization,
Department Institute of Chemistry,
Chinese Academy of Sciences (CAS).

3. Mr. Lu Hui-sheng,
Deputy Head,
Foreign Affairs Bureau,
Chinese Academy of Sciences (CAS).

4. Mr. Chia Shou-Chuan,
Head of Crystal Growth Department,
Institute of Physics,
Chinese Academy of Sciences (CAS).

5. Mr. Ku Pin-Yuan,
Head of Fodder Department,
Institute of Microbiology,
Chinese Academy of Sciences (CAS).

Plate No. 15 Members of the Chinese delegation with the President of Pakistan.

Plate No.16 Members of the Chinese delegation with the Prime Minister of Pakistan.

6. Mr. Kao Chin-tien,
Head of Research Department,
(Sorghum, Hybrid Corn, and Wheat),
Institute of Genetics,
Chinese Academy of Sciences (CAS).

7. Madam Wu Ling-an,
Interpreter (Research Worker),
Scientific Research Department,
Institute of Physics,
Chinese Academy of Sciences (CAS).

The delegation visited various scientific and technological institutions/establishments and universities in Islamabad, Rawalpindi, Lahore, Lyallpur, Karachi, Hyderabad and Peshawar. Besides the first hand knowledge of the scientific and technological research effort in the country the Delegation had discussions with the heads of the scientific establishments/ universities and the scientific workers. The tour of the Chinese scientists to Pakistan provided an opportunity to the scientists of our great friendly country, the People's Republic of China, to know the scientific and technological organizations of Pakistan and provided the opportunity to the Pakistani scientists to discuss matters of mutual interests with the distinguished delegates and learn from them the methods employed by their great country to achieve self reliance and self sufficiency. At the conclusion of the tour of the delegation list of the fields of collaboration with the corresponding institutions of the People's Republic of China was discussed.

d) Dr. S.M. Qureshi, Member (Science), Pakistan Science Foundation attended the fourth meeting of the Association for Science Cooperation in Asia (ASCA) held on the 14th April in Australia (Plate 17). The meeting was hosted by the Government of Australia in which delegations from Indonesia, India, Newzeland, Pakistan, Phillipines, Singapore, Thailand, Bangladesh, Japan, and Korea participated. A number of areas in scientific and technological research, namely, low cost housing, non-conventional sources of energy, natural products, post-harvesting technology and food processing were identified for cooperation.

The Pakistan delegation invited the Association for Science Cooperation in Asia to hold its next meeting in Pakistan. The Association accepted the offer to hold its sixth meeting in Pakistan provided a fresh invitation was extended by the Pakistan delegation attending the next (5th) meeting of the Association already scheduled to be held at Thailand.

The Member (Science), Pakistan Science Foundation also had a meeting with the Secretary Department of Science, Government of Australia and discussed with him possibilities of cooperation between Pakistan and Australia in various fields of science and technology. A few cases of training and expert assistance sent by the Ministry of Food and Agriculture, Government of Pakistan, to the Pakistan Embassy in Australia, were also discussed by him with the Secretary who assured Member(Science) and the representative of the Embassy that

Plate No. 17 Pakistani delegation at the 4th meeting of Association for Science Cooperation in Asia, Ambassador of Pakistan to Australia, Mr. Riaz Piracha addressing the inaugural session. On extreme left is Dr. S. M. Qureshi, Member Science, Pakistan Science Foundation.

all possible help needed by Pakistan would be given by the Government of Australia provided the request for the required assistance was routed through the proper diplomatic channels. It was also agreed that the Government of Australia would provide expert assistance in live-stock production in Pakistan and training facilities to Pakistani Scientists in different fields of Agriculture desired by the Ministry of Food and Agriculture, Government of Pakistan. The Government of Australia was also willing to receive a group of Pakistani Farmers. The results of these discussions have been intimated by Member (Scienc) to the Secretary, Ministry of Agriculture, Government of Pakistan requesting him to pursue the cases further with the Government of Australia. A report on the fourth meeting of ASCA has since been submitted by Member (Science) to the S & T R Division for further necessary action.

VIII. AWARDS AND FELLOWSHIPS:

The grant of awards, prizes and fellowships to individuals engaged in developing processes, products and inventions of consequence to the economy of the country:

A system of public recognition, awards and financial support for creative individuals was considered necessary to provide incentives and opportunities for discovery, invention and innovation. Foundation's Board of Trustees has accordingly approved the award of three gold Medals and ten cash prizes each year to the individuals engaged in inventions and innovations of consequence to the economy of the country. In addition to these ten fellowships of M.Sc and M.Phil for improving their qualification and also to Ph.Ds for the post doctoral research in the universities of Pakistan.

Nominations for PSF awards and fellowships shall be invited from various universities/institutions as well as Learned Bodies of the countries and scrutinized by the special committees of eminent scientists in each discipline.

IX. SURVEYS AND STATISTICS:

Special scientific surveys and collection of scientific statistics related to the scientific effort of the country:

a) Collection of Statistics on Scientific efforts of the Nation:

Work on the collection of statistics was initiated on the following aspects of Science:-

1. Scientific manpower.
2. Research Establishments.
3. Research Projects under study.
4. Scientific Journals published in the country.
5. Scientific societies functioning in the country.

The collection and compilation of these statistics would provide an inventory of the scientific resources of the nation, assist in the assessment of the pace of development in Science and would constitute an objective basis for future planning. The directory of the scientific periodicals and journals has already been published. The work on compilation of other directories is in progress.

b) Science Expedition to Northern Areas:

The scientific information collected by the Science Expedition to the Northern Areas is now being compiled.

c) Resources Survey:

The nation must rapidly increase production through a scientific management and development of its resources. In order to meet this need there is an urgent need of resources survey in the country to form the basis of scientific resources management and development. There are vast areas in Pakistan where resource development has been completely neglected. Even in the relatively more developed parts only a fraction of the available resources are utilized. The constraints are: (i) paucity of trained manpower and institutions and (ii) the lack of integration in resources survey and development agencies. It appears necessary to establish specialized institutions and university departments to undertake the training of manpower and a sustained programme of research and development. Pending this it is necessary to launch immediately programmes for resources survey, both by the universities and scientific/technological organizations and establishment, particularly in areas which have been badly neglected.

The Pakistan Science Foundation has launched the following programmes aimed at Resources Survey, planning and development.

The Northern Areas Resources Survey/Development: Under this programme, inter-disciplinary, inter-institutional teams of scientists from 20 universities/research establishments in the nation were organized for a resources survey of the Northern Areas of Gilgit, Baltistan and Diamir.

The Barani Areas Resources Survey and Development: Under this programme inter-disciplinary, inter-institutional scientific survey of the Barani Areas of the Punjab is in progress and would provide the nation with an indigenous model of such work. Once the man-power, data and technique constraints are identified, it would be possible to take remedial measures and to undertake systematic nation-wide work in all parts of the country.

Utilization wasted resources, e.g. fallow periods and residual moisture after rice harvesting in Sind, through the introduction of quick maturing H.Y.V. of hybrid sorghum and multiple cropping.

A number of other resource development projects such as resources survey and the development of Sind Lakes are in early stages of planning through committees of specialists.

The Arabian Sea & Persian Gulf waters are amongst the richest in the world in terms of natural resources, both mineral and biological. The scientific inventory and utilization of these resources is receiving PSF support on a priority basis. These potentially extensive and valuable resources should be fully exploited for the benefit of the nation, It is however reiterated that a big constraint in Resources Survey and Development work is the paucity of high-level trained man-power for this type of highly inter-disciplinary, inter-institutional work and the earlier our universities get into the field of man-power training and techniques, the earlier would the nation be in a position to fill the vast gap between the almost fabulous resources of Pakistan and the current disappointing performance, in particular in food production.

It may, however, be mentioned that the nature of the work involved is such that unless specialized institutes are established inside or outside of universities, it will not be possible to undertake the work on long term basis. Institutions like the Survey of Pakistan, Hydrological Survey units such as Water & Soil Investigation Department(WASID), the Geological Survey, the various Census organizations have, however, important contributions to make very strong and competent leadership is needed to successfully launch Resources Survey and Management Programmes. The PSF has already made a

highly successful beginning in this vital field and is already deploying an inter-institutional approach to such studies, if provided with the resources it would establish modest nuclei/units for Resources Development studies and Techniques development in the country.

A vast amount of data is available in the nation which has a direct bearing on resource utilization in village records in the various survey and census organization. This data is not, however, readily available and has not been used by the planners or the decision makers for integrated resources utilization planning. New and valuable information has also become available from the Earth Resources satellite and wider use should be made of remote sensing techniques. The Pakistan Science Foundation is endeavouring to establish Data and Information Banks for the purpose. The Pakistan Scientific and Technological Information Centre of Pakistan Science Foundation has already established cooperative arrangements for exchanging information with the centre for Integrated Natural Resource Management in Arid and Semi Arid Lands of the University of Arizona, USA.

X. RESEARCH EVALUATION:

Since scientific work lies in unchartered areas a central problem has been not only to establish a sound initial research plan but to ensure that the corrective feed back process is efficient. The following mechanism has, therefore, been developed for the review of the progress of scientific work financed by Pakistan Science Foundation:

- Quarterly research reports: These are submitted three months after the initiation of the project and after the submission of the Semi Annual and Annual reports. They serve as a continuing means of hearing about the progress being achieved. The progress of work is more fully described in semi-annual and annual reports.

- Semi-Annual reports: The six monthly reports are first examined by the Research Support Section and later sent to the technical experts in the relevant fields for review of the progress of the research work. The reviewers observations are then communicated to the Principal Investigator for his information and necessary action.

- Annual reports: The annual reports are submitted each year after the initiation of project and are examined by the relevant Technical Committees for detailed evaluation. If necessary, the Technical Committees may appoint specialist sub-committees for the purpose comprising generally of active Scientific workers in the concerned disciplines.

XI. SCIENTISTS POOL:

For the proper utilization of the highly qualified workers and to arrest brain drain and flight of talent, a Scientists Pool has been established by the Foundation. Pakistani scientists working abroad were invited through newspaper advertisements and also through our embassies in the advanced countries to register themselves with the Foundation and were informed if they wished to return, pending regular appointment, they would as scientists pool officers receive a maintenance allowance. In all, 20 scientists have availed of the facilities so far.

Out of 13 scientists enlisted in the year 1973-74 the following have been assisted in obtaining gainful employment either in a university or in research/technical organizations:

1. Dr. Mohammad Viqar Ahmed
2. Dr. Mohammad Irshad Khan
3. Dr. Fayyaz Ahmed Qureshi
4. Dr. Mohammad Rashid
5. Dr. Abdul Ghafoor
6. Dr. Khadim Malik
7. Dr. Mohammad Ali
8. Dr. M.A. Khawaja
9. Dr. Miss Azra Sultana Ahmad
10. Mr. Mohammad Ishaq Javed.

A placement office has now been created in the Pakistan Science Foundation to maintain the national register of highly qualified and talented scientists in Pakistan, including Engineers and Doctors, in or outside the country and to assist them in finding appropriate employment. It will establish liaison with appropriate agencies such as the Manpower Division of the Government of Pakistan, the universities and research establishment centres, industries and corporations etc., to perform the afore-said function. It will also study the ways and means adopted by other developing countries for the implementation of similar programmes and formulate concrete proposals for the placement work to be undertaken by it.

XII. INTERNATIONAL LIAISON:

Liaison with similar bodies in other countries:

Representatives of several foreign organizations paid visit to the Pakistan Science Foundation in order to explore the possibilities of collaboration in programmes such as the scientific research, exchange of information and scientists exchange etc.

Close liaison is being established with UNESCO, The Chinese Academy of Sciences, the U.S. National Science Foundation, the US Academy of Sciences etc. interested in scientific and technical cooperation. Correspondence with numerous scientific organizations all over the world has been carried out concerning problems of mutual interest.

CHAPTER - 2

PROGRESS REPORT ON RESEARCH PROJECTS SUPPORTED DURING 1973-74:

Pakistan Science Foundation sanctioned 26 research projects during the year 1973-74 (Annexure VIII). Out of these, eight projects were implemented during the period under report (Annex - VIII A), fourteen projects (Annex-VIII B) remained in progress for short periods during which time only preparatory work of preliminary nature was done and work on the remaining four projects (Annex-VIII C) were not initiated due to one reason or another. Attempts are being made to ensure that these are initiated without further delay.

Work accomplished under the above-mentioned eitht projects is summarized below:

S-KU/OCEAN (2):

Title: Studies on Settlement and control of Marine Organisms in Cooling Systems of Coastal installations:

Considerable damage to the sea water cooling system, of the power plant, by fouling organisms of the sea had been reported by Karachi Nuclear Power Plant (KANUPP). It was observed that during sea water circulation through heat exchanger tubings, many organisms like larvae of barnacles and molluscs tended to settle and grow and thus caused considerable damage to the power plant cooling system. This project was therefore undertaken to determine the ways and means to control the settlement of these organisms in the cooling system of KANUPP.

During the first year of the project, ecological studies concerning the fouling organisms, the abundance and settlement of their larvae in different seasons and conditions both in the natural environment and inside the Power Plant have been investigated. On the basis of these studies it has been concluded that control measures can be effectively adopted by applying suitable treatment only for a total period of five months in certain seasons during the year when larvae are abundant. It has also been established that the present mode of chlorination is not adequate and requires to be changed considering other factors which may affect settlement. Work on both these aspects may result in substantial economy in the cost of treatment for controlling settlement of fouling organisms in cooling systems.

S-KU/BIO (52):

Title: Marine Molluscs of Pakistan:

The coastal area of Pakistan embraces a wide variety of habit and the warm food-laden water provides suitable conditions for the development of molluscan communities.

In order to study the molluscan fauna of the coastal area of Pakistan,collections were made by hauling from numerous places along the Karachi coast of the Northern Arabian Sea. These included off-shore and deep sea samples as well. About 1,000 specimens belonging to different categories of Molluscs were collected. From this huge collection, eighty specimens have so far been identified.

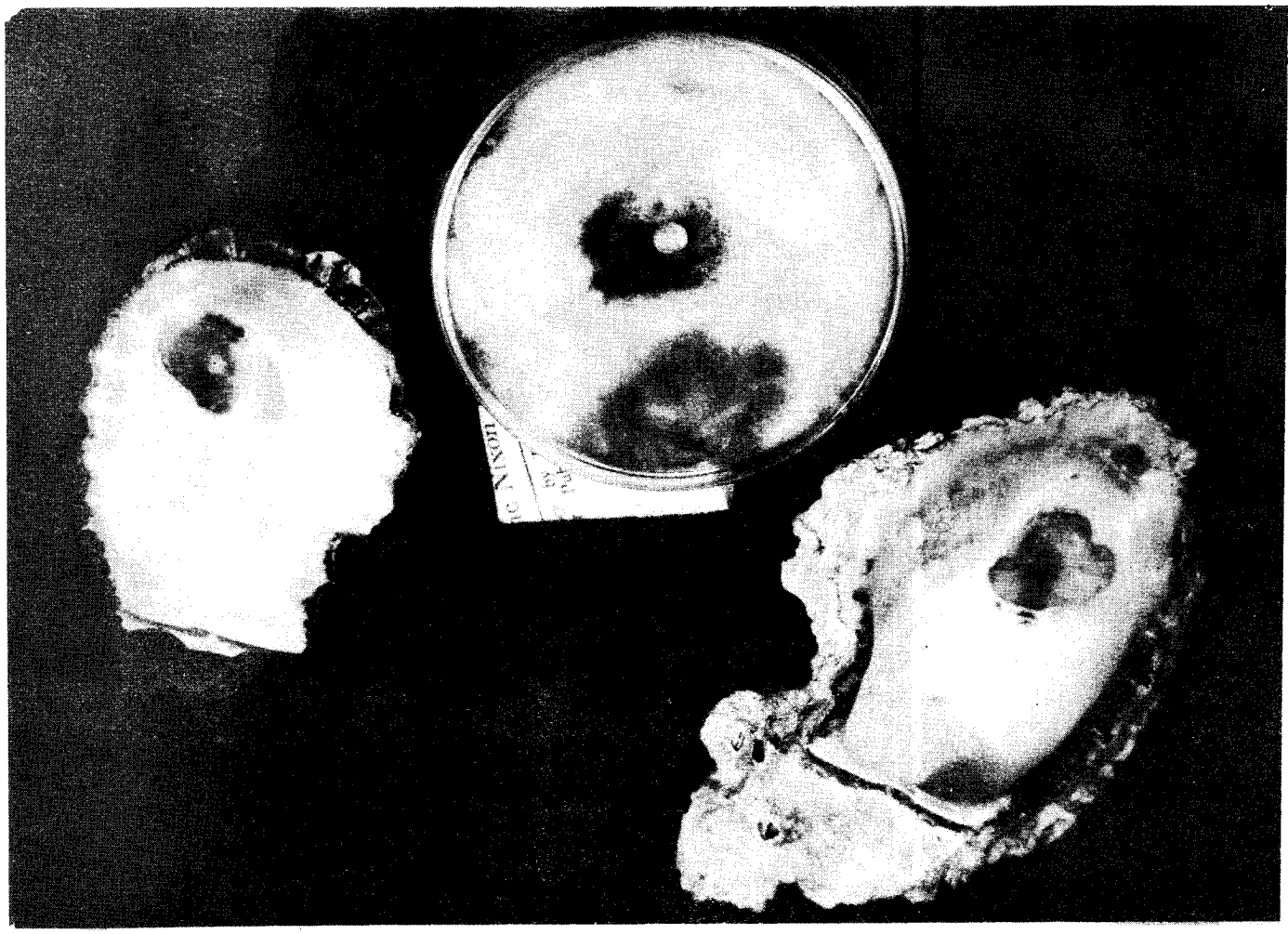


Plate No. 18 Pearl Oyster containing a pearl is reported for the first time from the Karachi coast.

Studies on the distribution, range habitat and the diagnostic characters of 50 species have been completed and the identification of these species has been confirmed by several scientific organizations. During the course of the study, a pearl was found from an oyster (Grasses treberculata) on 30th April, 1975. The pearl is almost round and lustrous. It measures 3.55 mm in diameter and weights 53.6 mg. The find was reported in a daily Newspaper on 28th May, 1975 and Televised on 21st June, 1975 in the Programme "Tarjuman". Both the pearl and the pearl oyster have been deposited in the Invertebrate-Reference-Museum, of the Karachi University (Plate 18).

Further work on other specimens is in progress.

C-IU/CHEM (14):

Title: Studies in thermodynamics of interaction of solid catalysts with gases, liquids and vapours:

Hydrogenation of vegetable oil to obtain vegetable ghee is extensively carried out in Pakistan. To catalyse the hydrogenation process, nickel is used as a catalyst. It is observed by the industry, that the catalyst becomes useless after ten to twenty runs and is therefore discarded. The used and discarded catalyst contains a fair amount of precious nickel metal. The objective of this research project is to reactivate the used catalyst or procure nickel metal from the waste as salts. Salts of nickel are expensive and they find an extensive use in nickel plating.

Various used samples from local vegetable ghee industries were collected and analysed. Also subjected to analysis were samples of unused catalyst which had been imported by various ghee industries of Pakistan. The analysis of the catalyst obtained from Fazal Vegetable Ghee Industries yielded metallic nickel 28%,kiesulghur clay 14% and hydrogenated fat 57%. The same catalyst after use yielded metallic nickel 24%, clay 24%, hydrogenated fat 50% and moisture 2%. While the analysis on catalyst samples from Kohinoor ghee industries showed the presence of metallic nickel 25%, nickel formate 5% and hydrogenated fat 7%. However after use the catalyst yielded metallic nickel 23%, fuller's earth/clay 32%, hydrogenated fat 40% and moisture 3%.

Starting with used nickel catalyst, four compounds have been prepared in this laboratory namely nitrate, sulphate, carbonate and formate of nickel. The preparation of activated nickel catalyst from the salts is now under progress.

S-SU/CHEM(30)

Title: Chemical Analysis and Utilization of certain substandard or uneconomic Minerals and Ores of Pakistan:

The project envisages studies on certain mineral resources of Pakistan which are said to be of poor quality and are not being exploited commercially at present. These are proposed to be converted into more useful and economically feasible products.

The sample of celestite obtained from different departments near Thana Bola Khan were analysed for their strontium content. The ore was found to contain 97 + 1.5% of strontium sulphate. Laboratory work on this mineral has thus been completed. Feasibility study to find whether the process is workable on pilot plant scale is now proposed to be undertaken.

Analysis of Bauxite samples obtained from Larkana Sind and Khatta Marshad, Sargodha district (Punjab), was made for its Alumina AL_2O_2 contents. The average of Alumina in these substandard samples was found to be 20 + 1.0%. Pure Alumina has been prepared and the yield has been 19.8%. Various useful salts such as Alum, Al Cl_3 (Aluminium Chloride) Al (No 3)$_3$ (Aluminium Nitrate) etc., can be economically prepared from it by ordinary well known methods and the work towards this end is now in progress

S-SU/CHEM (46):

Title: Chemical Composition of Hair Root as a Criterion of Protein Malnutrition:

The proposed study was designed to help diagnose and detect protein-calorie malnutrition among children at early stages so that treatment could be started in time to prevent some of the defects, particularly impaired mental development, which results from prolonged malnutrition.

Hair roots from patients suffering from Kwashiorkor and Marasmic diseases were collected and tested for various contents. Hair roots were also collected from healthy subjects for comparative study. It was observed that the protein content of the hair roots of patients decreased to half the normal value in all the samples of protein calorie malnutrition (PCM) while the DNA decreased to half in patients suffering from Kwashiorkor and marasmic Kwashiorker but to a little less than half in those suffering from marasmus only. This decline in DNA and protein content is very large and is quite significant. The lower fall in DNA in Marasmus may indicate more activity in Marasmus than Kwashiorkor with respect to follicle growth and if confirmed may be a possible bio-chemical difference between these two conditions to help diagnosis.

Further work on the project is in progress.

S-KU/CHEM(46):

Title: Cell and Tissue Culture Research:

Biochemistry Department of the Karachi University is fairl well equipped both in terms of materials and manpower. It, however needed additional equipment to enable it to function at an optimum level of efficiency. In order to strengthen its existing capabilities, University was given financial assistance to introduce the tissue culture studies in its Biochemistry Department.

Work is in progress for the preparation of media and optim temperature requirements for different types of cells. The product of monolayers from the disintegrated stomach cells has been achiev No individual procedure has yet been established for culturing of stem tissues. Moreover, various techniques like microbial cell culture, development of Biochemical methods and lederberg's techni for obtaining amino acid Auxotrophs are in practice.

It may be stated that the tissue culture facilities have been introduced for the first time in one of the Universities. Earlier these facilities were confined to the specialized medical centres for investigating specific medical problems. It would now be possible to undertake sophisticated research on problems of practical importance involving tissue culture technique.

S-KU/PHY (3):

Title: Electronic Spectra of Metallic Hydrides:

The analysis of the band systems of different elements and compounds is essential for understanding of the physics of atoms and molecules. The object of this scheme was to obtain the band systems of some metallic hydrides in the ultraviolet region. As a result of the work done so far, two violet degraded close lying band systems of CaH and CaD at 3060 A^{o} have been observed in absorption. These bands were analysed and evaluated. Similarly new band systems of SrH and SrD have been observed and analysed. Experimental studies on the spectra of hydrides of Zn and Cd were also made.

The observations on the spectra of the hydrides are likely to lead to the precise information about their rotational, vibrational and electronic energy levels. From these energy levels the intermoleculer distances, the vibrational frequencies and data concerning the structure of diatomic molecules may be determined accurately for correct concepts and deep understanding of physics of molecules and atoms.

P-PU/PHY(11):

Title: High Energy Phenomenology:

The dual absorptive model and other models have been used to analyse hadron-hadron and photoproduction reactions at high energy in order to explain the structure of two body reactions.

As a result of the study undertaken, Regge theory has been modified to explain the freshly available data concerning particle-particle and particle-nucleus interaction. Two reactions i.e., pp elastic scattering and duetran scattering were explained on the basis of Dual Absorptive model and Vector Dominance Model. Two scientific papers were prepared, which have been accepted for publication in Australian Journal of Physics. Besides this a third paper, explaining a discrepancy existing between the experimental and theoretical results, was presented at the 14th International Conference on Cosmic Rays.

The results obtained will help physicists in having an insight into the structure of elementary particles.

CHAPTER - 3

Organization and Administration

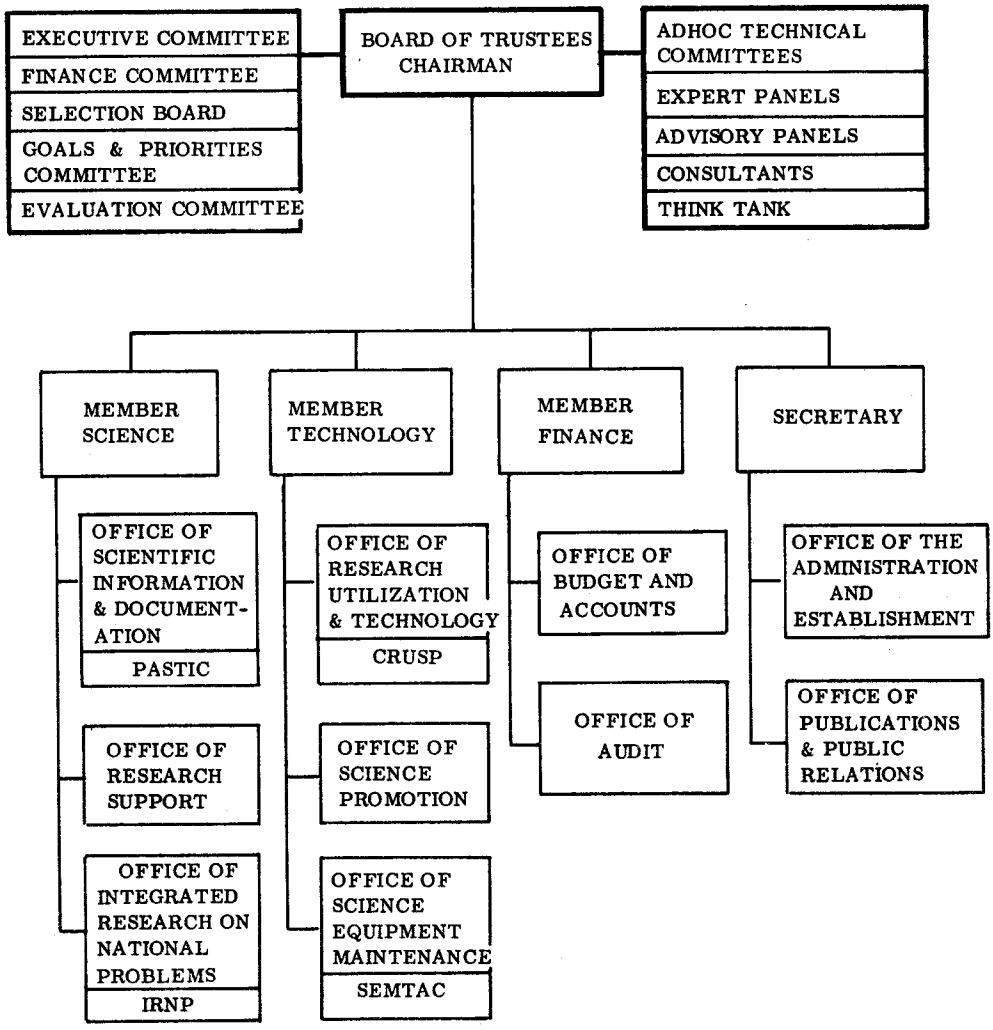
The ultimate organizational and administrative structure of the Foundation conceptualized as a result of the deliberations of the Joint Pak-American Science Review Team is given in the charts on page 91 and 92. During the year under report however only a small component of the proposed structure was inducted, and the present staff of the Foundation is as follows:-

OFFICERS:

S.No.	Designation	Number
1.	Chairman	1
2.	Member (Science)	1
3.	Member (Finance)	1
4.	Secretary	1
5.	Deputy Director(Finance & Accounts)	1
6.	Senior Scientific Officer	1
7.	Scientific Officer	4
8.	Placement Officer	1
9.	Statistical Officer	1
10.	Accounts Audit Officer	1
11.	Public Relations Officer	1
12.	Superintendent	1
13.	Supporting Clerical Staff	18

In addition to the whole-time staff members of the Foundation, there are about 250 scientists and technologists in various universities/research organizations who are acting in an honorary capacity as reviewers of the research proposals or serving on the technical/other committees and expert/advisory panels of the Foundation.

PROPOSED ORGANIZATION
PAKISTAN SCIENCE FOUNDATION



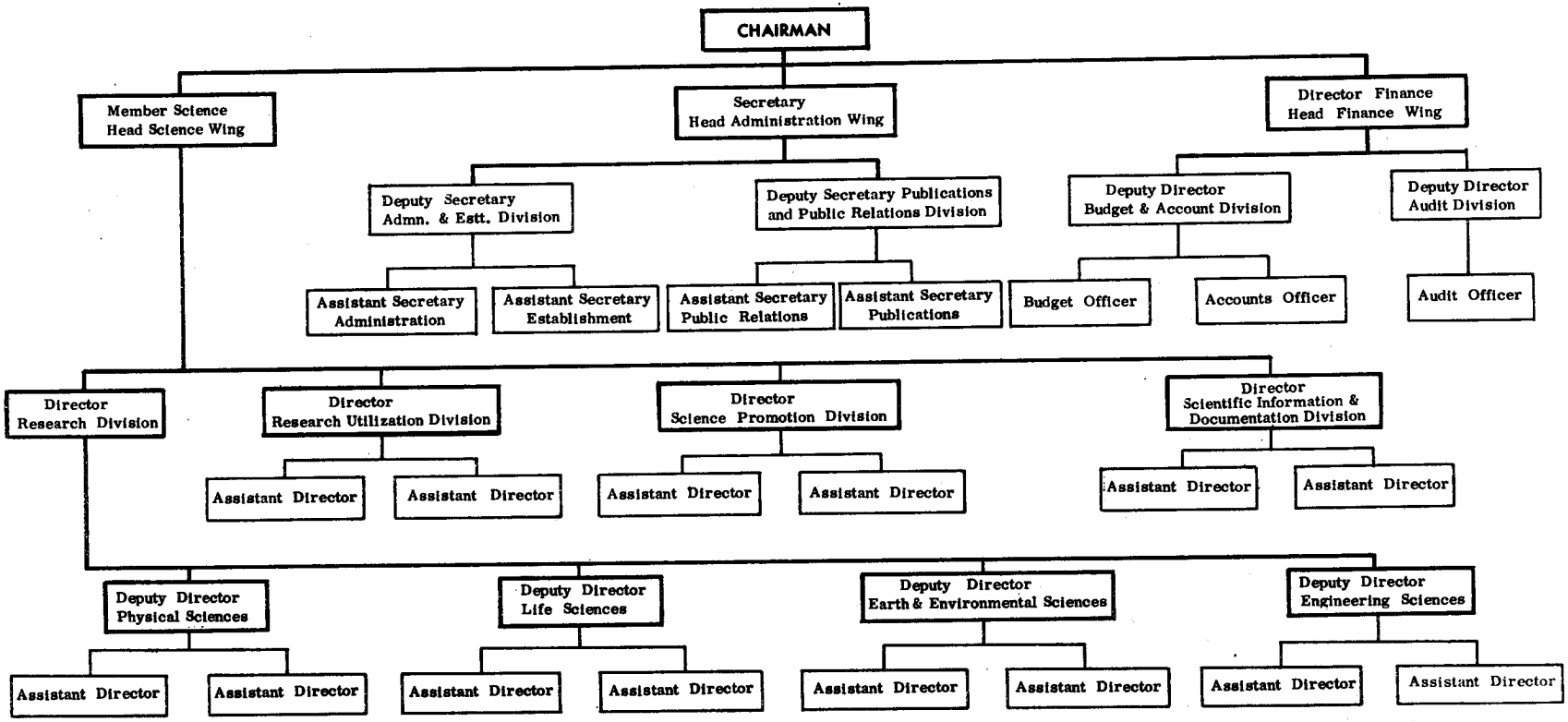
PASTIC : PAKISTAN SCIENTIFIC AND TECHNOLOGICAL INFORMATION CENTRE

CRUSP : CENTRE FOR RESEARCH UTILIZATION AND SPECIAL PROJECTS

IRNP : INTEGRATED RESEARCH ON NATIONAL PROBLEMS

SEMTAC : SCIENCE EQUIPMENT MAINTENANCE TECHNICAL ASSISTANCE CENTRE

PAKISTAN SCIENCE FOUNDATION
ADMINISTRATIVE STRUCTURE
1975



CHAPTER 4

The report of the Auditors Messrs Riaz Ahmad & Co., Chartered Accountants, appointed by the Foundation in consultation with the Auditor General of Pakistan, is reproduced below:-

AUDITORS' REPORT TO THE CHAIRMAN AND BOARD OF TRUSTEES OF PAKISTAN SCIENCE FOUNDATION

We have examined the annexed Balance Sheet of Pakistan Science Foundation as at June 30, 1975 and the Income and Expenditure Account for the year then ended, and subject to our separate report of March 27, 1976 addressed to the Board of Trustees, we report that:-

a) we have obtained all the information and explanations we required; and

b) such balance sheet exhibits a true and correct view of the state of the Foundation's affairs, according to the best of our information and explanations given to us and as shown by the books of the Foundation.

Sd/-(RIAZ AHMAD & CO.)
CHARTERED ACCOUNTANTS

LAHORE, March 27, 1976

PAKISTAN SCIENCE FOUNDATION, ISLAMABAD
BALANCE SHEET AS AT JUNE 30, 1975

FUNDS AND LIABILITIES	NOTE	1975 Rs.	1974 Rs.	PROPERTY AND ASSETS	NOTE	1975 Rs.	1974 Rs.
FUNDS				FIXED ASSETS (As per schedule annexed)			
Grants	1	1,12,19,801	84,00,000				
Less: Expenditure during the year		58,77,908	21,80,199	At cost less accumulated depreciation		31,59,512	3,03,690
		53,41,893	62,19,801				
RESEARCH SUPPORT GRANTS	2	51,39,496	12,38,010	RESEARCH PROJECTS IN PROGRESS	6	51,39,496	12,38,010
CURRENT LIABILITIES				CURRENT ASSETS			
For expenses	4	88,637	43,305				
For other finance	5	15,50,014	3,08,532	Accounts receivable	7	22,224	4,45,300
		16,38,651	3,51,837	Advances, deposits and pre-payments	8	90,842	91,676
				Cash and bank balances	9	37,07,966	57,30,972
						38,21,032	62,67,948
	Rs.	1,21,20,040	78,09,648		Rs.	1,21,20,040	78,09,648

AUDITORS' REPORT

(See annexed report of date)

Sd/- (RIAZ AHMAD & CO.)
CHARTERED ACCOUNTANTS

LAHORE, March 27, 1976.

The above balance sheet should be read in conjunction with the notes on accounts set out on pages 97 to 101.

PAKISTAN SCIENCE FOUNDATION, ISLAMABAD

SCHEDULE OF FIXED ASSETS AS AT JUNE 30, 1975.

PARTICULARS	COST			DEPRECIATION			WRITTEN DOWN VALUE AS AT JUNE 30, 1975	RATE %
	As at July 1, 1974	Additions during the year	As at June 30, 1975	As at July 1, 1974	Provided for the year	As at June 30, 1975		
Leasehold land	-	28,33,333	28,33,333	-	-	-	28,33,333	-
Furniture and fixture	1,05,981	25,603	1,31,584	6,359	7,513	13,872	1,17,712	6
Office equipment	62,637	37,715	1,00,352	9,395	13,643	23,038	77,314	15
Air-conditioners	74,764	-	74,764	11,214	9,532	20,746	54,018	15
Vehicles	1,06,699	467	1,07,166	21,339	17,166	38,505	68,661	20
Cycle	359	-	359	71	58	129	230	20
Library books	1,714	7,050	8,764	86	434	520	8,244	5
Rs.	3,52,154	29,04,168	32,56,322	48,464	48,346	96,810	31,59,512	

PAKISTAN SCIENCE FOUNDATION, ISLAMABAD

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED JUNE 30, 1975

	NOTE	1975 Rs.	1974 Rs.
EXPENDITURE			
Grants	10	45,43,632	16,26,406
Administrative and others	11	9,30,812	4,08,808
Travel grants for scientific surveys, Science Conferences and Seminars	12	2,82,976	80,817
Scientists' Pool	13	1,25,371	64,168
		58,82,791	21,80,199
INCOME			
Interest received		1,000	-
Adjustments in respect of prior years		3,883	-
		4,883	-
EXPENDITURE CARRIED FORWARD TO BALANCE SHEET		58,77,908	21,80,199

AUDITORS' REPORT

(See annexed report of date)

Sd/-(RIAZ AHMAD & CO.)
CHARTERED ACCOUNTANTS

LAHORE, March 27, 1976.

The Income and Expenditure Account should be read in conjunction with the notes on accounts set out on pages 97 to 101.

PAKISTAN SCIENCE FOUNDATION, ISLAMABAD

NOTES ON ACCOUNTS FOR THE YEAR ENDED JUNE 30, 1975

		1975 Rs.	1974 Rs.
GRANTS			
1.	Balance as at July 1, 1974	62,19,801	-
	Add: Grants sanctioned and received during the year	50,00,000	84,00,000
	Balance as at June 30, 1975	1,12,19,801	84,00,000

2. In accordance with the principles outlined in the charter, grants totalling Rs. 39,01,486 have been paid by the Foundation during the year for the conduct of various approved scientific research projects. The position is summarised below:-

Balance as at July 1, 1974	12,38,010
Grants paid during the year for finalized agreements	39,01,486
Balance as at June 30, 1975	51,39,496

3. The grantees have undertaken to incur the grants as per the provisions of the agreement and for the performance of execution of the research project for which the grant has been paid. Accordingly, these grants are being carried forward in the accounts of the Foundation, and shall be written off or reduced as and when the expenditure is incurred and the proper account thereof is rendered to the Foundation on the conclusion of the projects.

CREDITORS FOR EXPENSES

4. These are made up of:

House rent	6,600	4,500
Salaries	27,465	16,549
Repairs and maintenance	139	-
Stationery and printing	20,429	500
Medical	6,817	-
Entertainment	-	644
Vehicle running	2,953	171
Travelling	1,013	859
Advances	1,505	-
Grants for research support	1,243	-
Audit fee	3,500	2,250
Furniture	3,320	15,384
Newspapers and periodicals	220	-
Leave salary and pension contribution	1,361	-
Water, electricity and gas	1,036	-
Postage, telegrams and telephones	11,036	2,448
	88,637	43,305

	1975 Rs.	1974 Rs.
CREDITORS FOR OTHER FINANCE		
5. These comprise of:		
Grants received on behalf of Pakistan Scientific and Technological Information Centre (PASTIC) by the Foundation	11,61,843	3,00,000
Profident fund account	3,84,948	1,638
Income tax	929	1,834
G.P. Fund	886	2,174
Benevolent fund	664	593
House building advance	365	1,891
Group life insurance	313	229
Motor cycle advance	10	117
Postal life insurance	56	56
	15,50,014	3,08,532

The balance payable to PASTIC is made up as under:-

Balance with treasury	8,61,843*
Balance with National Bank of Pakistan, Model Branch, Islamabad, frozen by Bank against letter of credit.	3,00,000
	11,61,843

*Against this balance, land worth Rs. 6,00,000 is shown under fixed assets.

RESEARCH PROJECTS IN PROGRESS

6. This represents the expenditure incurred on the various projects which are still in progress (Refer notes 2 and 3).

ACCOUNTS RECEIVABLE		
7. Advance to PASTIC	-	4,45,300
Advance to Punjab Barani Commission	22,224	-
	22,224	4,45,300

		1975 Rs.	1974 Rs.
ADVANCES, DEPOSITS AND PREPAYMENTS			
8.	These are made up of:-		
	Advances		
	Northern area expedition	11,686	46,975
	Books	338	2,115
	Staff	29,155	4,236
		41,179	53,326
	Deposits		
	Telephones	2,250	2,250
	Sui-gas	1,000	1,000
		3,250	3,250
	Prepayments		
	Rent	46,413	35,100
		90,842	91,676
CASH AND BANK BALANCES			
9.	In hand	6,167	8,864
	With banks		
	In current account	11,13,116	5,04,608
	In C.P.F. account	3,88,440	-
	With Government treasury	22,00,243	52,17,500
		37,01,799	57,22,108
		37,07,966	57,30,972
GRANTS			
10.	Research support	39,01,486	12,38,010
	Scientific societies and professional bodies	2,88,579	-
	Exchange of visits of scientists and technologists (Chinese scientists delegation)	57,495	-
	Information and documentation	17,072	-
		42,64,632	12,38,010
	Science conferences and seminars	2,79,000	3,88,396
		45,43,632	16,26,406

		1975 Rs.	1974 Rs.
ADMINISTRATIVE AND OTHER EXPENDITURES			
11.	Salaries - officers	2,17,263	1,01,251
	Salaries - staff	1,97,817	66,706
	Honorarium	925	1,080
	Provident fund contribution	-	1,525
	Leave salary and pension contribution	24,337	5,899
	Medical	43,529	860
	Travelling - officers	37,858	20,236
	Travelling - staff	4,103	4,552
	Rent - office	55,600	24,976
	Rent - residential	90,802	53,810
	Water, electricity and gas	6,242	1,613
	Postage, telegrams and telephone	78,148	17,019
	Stationery	52,764	22,063
	Vehicles running	31,424	10,649
	Newspapers and periodicals	2,553	663
	Liveries and uniforms	5,568	3,369
	Entertainment	6,762	7,099
	Insurance	788	-
	Conveyance	506	-
	Repairs and maintenance vehicles	8,424	-
	Repairs on office equipment	2,192	-
	Repairs on buildings	504	-
	Depreciation	48,346	48,464
	Contingencies	4,121	2,636
		9,20,576	3,94,470
OTHER EXPENDITURES			
	Audit fee	2,250	2,430
	Advertisement	7,666	11,908
	Bank charges	320	-
		10,236	14,338
		9,30,812	4,08,808
TRAVEL GRANTS FOR SCIENTIFIC SURVEYS, SCIENCE CONFERENCES AND SEMINARS			
12.	Local	1,18,019	42,935
	Foreign	1,64,957	37,882
		2,82,976	80,817

		1975 Rs.	1974 Rs.
SCIENTIFIC POOL			
13.	Salaries	1,23,365	58,171
	Travelling	2,006	5,997
	Rs.	1,25,371	64,168

GENERAL

14. The figures have been rounded off to the nearest rupee and re-arranged for comparison purposes wherever necessary.

Annexure - I

PAKISTAN SCIENCE FOUNDATION ACT 1973

National Assembly of Pakistan

Islamabad, the 2nd February,

1973

The following Acts of the National Assembly received the assent of the President on the 31st January, 1973 and hereby published for general information:-

Act No. III of 1973

An Act to provide for the establishment of the Pakistan Science Foundation.

Whereas it is expedient to provide for the establishment of the Pakistan Science Foundation and for matters ancillary thereto,

It is hereby enacted as follows:-

1. SHORT TITLE, EXTENT AND COMMENCEMENT - (This Act may be called the Pakistan Science Foundation Act, 1973.

(2) It extends to the whole of Pakistan.

(3) It shall come into force at once.

2. DEFINITIONS.- In this Act, unless there is anything repugnant in the subject or context,-

(a) "Board" means the Board of Trustees of the Foundation;

(b) "Chairman" means the Chairman of the Foundation; and

(c) "Foundation" means the Pakistan Science Foundation established under this Act.

3. ESTABLISHMENT OF THE FOUNDATION.- (1) As soon as may be after the commencement of this Act, the Federal Government may, by notification in the official Gazette, establish a Pakistan Science Foundation to promote and finance scientific activities having a bearing on the socio-economic needs of the country.

(2) The Foundation shall be a body corporate by the name of the Pakistan Science Foundation, having perpetual succession and a common seal, with power, subject to the

provisions of this Act, to acquire, hold and dispose of property, both movable and immovable, and shall by the said name sue and be sued.

(3) The head office of the Foundation shall be at Islamabad.

4. FUNCTIONS OF THE FOUNDATION.- (1) The Foundation shall function as a financing agency for:

(i) the establishment of comprehensive scientific and technological information and dissemination centres;

(ii) the promotion of basic and fundamental research in the universities and other institutions on scientific problems relevant to the socio-economic development of the country;

(iii) the utilization of the results of scientific and technological research including pilot plant studies to prove the technical and economic feasibility of processes found to be promising on a laboratory scale;

(iv) the establishment of science centres, clubs, museums, herbaria and planetaria;

(v) the promotion of scientific societies, associations and academies engaged in spreading the cause of scientific knowledge in general or in the pursuit of a specific scientific discipline or technology in particular;

(vi) the organization of periodical science conferences, symposia and seminars;

(vii) the exchange of visits of scientists and technologists with other countries;

(viii) the grant of awards, prizes and fellowships to individuals engaged in developing processes, products and inventions of consequence to the economy of the country; and

(ix) special scientific surveys not undertaken by any other organization and collection of scientific statistics related to the scientific effort of the country.

(2) The Foundation shall also -

(i) review the progress of scientific research sponsored by it and evaluate the results of such research;

(ii) maintain a National Register of highly qualified and talented scientists of Pakistan, including engineers and doctors, in or outside the country and to assist them, in collaboration with the concerned agencies in finding appropriate employment; and

(iii) establish liaison with similar bodies in other countries.

(3) In the performance of its functions, the Foundation shall be guided on questions of policy by the instructions, if any, given to it by the Federal Government which shall be the sole judge as to whether a question is a question of policy.

5. BOARD OF TRUSTEES.- (1) The general direction, conduct and management of the affairs of the Foundation, including administration of its funds, shall vest in a Board of Trustees consisting of the following members, namely:

Whole-time members

(i) the Chairman;

(ii) one eminent scientist;

(iii) the Director of Finance;

to be appointed by the President;

Part-time members

(iv) the Chairman of the National Science Council;

(v) four scientists to be nominated by the National Science Council; and

(vi) elevan eminent scientists to be nominated by the President.

(2) The remuneration and other terms and conditions of service of the Chairman and the two other whole-time members of the Board shall be such as may be determined by the President.

6. CHAIRMAN OF THE BOARD.- The Chairman of the Board shall be the Chairman of the Foundation and shall be appointed for a term of three years from amongst the eminent scientists of the country having experience of research and scientific administration.

7. TERM OF MEMBERS OF THE BOARD.- The members of the Board, other than the ex officio member, shall hold office for a term of three years and shall be eligible for re-appointment or re-nomination, as the case may be.

8. MEETINGS OF THE BOARD.- (1) The meetings of the Board shall be held at least twice a year and shall be presided over by the Chairman or, in his absence, by its whole-time scientist member.

(2) All decisions at a meeting of the Board shall be taken by a majority of the votes of the members present and voting.

9. QUORUM AT THE MEETING OF THE BOARD.- To constitute a quorum at a meeting of the Board not less than nine members shall be present.

10. EXECUTIVE COMMITTEE.- There shall be an Executive Committee consisting of the Chairman and the two whole-time members of the Board.

11. DELEGATION OF POWERS.- The Board may, from time to time, delegate to the Chairman or the Executive Committee such of its powers and functions as it may consider necessary.

12. AD HOC COMMITTEE.- The Foundation may set up ad hoc committee consisting of university professors and other leading scientists and experts to scrutinize applications for financial assistance for carrying out scientific research submitted to the Foundation by the universities or other institutions or by individual scientific workers or groups of scientific workers and to review and evaluate the results of research sponsored by the Foundation.

13. FUNDS.- The funds of the Foundation shall consist of -

(a) grants made by the Federal Government and the Provincial Governments;

(b) donations and endowments; and

(c) income from other sources.

14. BUDGET.- The Foundation shall cause to be prepared and approve a statement of its receipts and expenditure for each financial year.

15. ACCOUNTS AND AUDIT.- (1) The funds of the Foundation shall be kept in a personal ledger account of the Foundation with the State Bank of Pakistan or with any Branch of the National Bank of Pakistan acting as an agent of the State Bank.

(2) The accounts of the Foundation shall be maintained in such form and manner as the Auditor-General of Pakistan may determine in consultation with the Federal Government.

(3) The accounts of the Foundation shall be audited by one or more auditors who are chartered accountants within the meaning of the Chartered Accountants Ordinance, 1961 (X of 1961), and are appointed by the Foundation in consultation with the Auditor-General of Pakistan.

16. APPOINTMENT OF OFFICERS AND SERVANTS.- (1) The Foundation may appoint such officers and servants, and engage such consultants or experts, as it may consider necessary for the efficient performance of its functions, on such terms and conditions as it may deem fit.

(2) In fixing the terms and conditions of service of its officers and servants, the Foundation shall as nearly as may be conform to the scales of pay, allowances and conditions of service applicable to the corresponding class of employees of the Federal Government.

17. ANNUAL REPORT.- (1) The annual report of the Foundation, which shall, among other things, clearly bring out the benefits accruing to the nation as a result of the activities sponsored by the Foundation, shall be prepared by the Chairman and submitted, through the Board, to the Federal Government alongwith the audited accounts of the Foundation.

(2) The annual report alongwith the audited accounts of the Foundation shall be laid before the National Assembly.

18. REGULATIONS.- The Foundation may make Regulations for the efficient conduct of its affairs.

19. REPEAL.- The Pakistan Science Foundation Ordinance, 1972 (LII of 1972), is hereby repealed.

Budgetary allocation for various programmes 1974-75

		Rs.
1.	Grants for research support	40,00,000
2.	Information and documentation	N I L
3.	Utilization of results of research and transfer of technology	7,00,000
4.	Science centres, herbaria, science clubs & Museums.	33,00,000
5.	science conferences, including meetings of boards/committees.	1,50,000
6.	Exchange of visits of scientists and technologists	
7.	Awards, prizes & fellowships	40,500
8.	Scientific survey and collection of statistics.	2,60,000
9.	Experts and consultants	50,000
10.	Scientist's Pool	1,00,000
11.	Scientific societies and professional holdings.	2,00,000
	Total:	1,05,58,500

Annexure III

LIST OF SANCTIONED RESEARCH GRANTS 1974-75:

No.	List of schemes	Amount sanctioned	Name of Principal Investigator and organization supported.
1.	Agricultural Sciences		
i)	Effects of tractor powered tillage practices on crop yield and soil characteristic. P-Au/Agr(5).	1,14,764.00	Dr. Ghulam Sarwar Sheikh, University of Agriculture, Lyallpur.
ii)	Biological control of soil salinity and fertility. P-NIAB/Agr(17)	2,85,737.00	Dr. G.R. Sandhu, Nuclear Institute of Agriculture & Biology, Lyallpur.
iii)	Exploration of nitrogen fixing Algae in the Agriculture fields of Sind. S-Su/Agr(13).	2,34,421.00	Dr. Shahnawaz Arbani, Department of Fresh Water Biology, Sind University, Jamshoro.
iv)	Survey, collection and study of the mites attacking different crops in Sind and their control. S-AC/Agr(18).	1,20,820.00	Mr. Abdul Hyee Soomro, Sind Agriculture College, Tando-Jam.
v)	Studies and evaluation of physiological changes induced in the biotic community of the agricultural land by the use of pesticides. C-IU/Agr(22).	2,35,308.00	Dr. M. Arsalan, Department of Biological Sciences University of Islamabad.
vi)	Veterinary disease Investigations in Northern Areas. Res/35(3):	6,45,296.00	Dr. Riaz Ahmed, Disease Investigation Laboratory, Northern Areas, Gilgit.

2. Biological Sciences:

i)	Investigation into the occurence, biology and histo-chemistry of larval trematodes in Pakistan. P-Pu/Bio(9).	68,892.80	Dr. Daler Khan, Zoology Department, Punjab University, Lahore.
ii)	A faunistic study and biology of fishes of NWFP. F-PU/BIO(11).	1,40,385.00	Dr. Nasim Siddiqui, Chairman, Zoology Department, Peshawar University.
iii)	Utilization of brackish water for growing plants on sandy belts of Pakistan. S-KU/BIO (13).	1,93,377.00	Dr. Rafiq Ahmad, Botony Department, University of Karachi.
iv)	Systematics, biology and seasonal abundance of planktons in the Karachi coastal waters. S-Ku/BIO (16).	1,01,021.00	Dr. M.A. Khan, Zoology Department, University of Karachi.
v)	Taxonomic studies of some marine invertebrates of the Northern Arabian Sea. S-Ku/BIO (20).	2,00,359.00	Dr. Naseema Tirmizi, Officer Incharge, Invertebrate Reference, Museum, Karachi University.
vi)	Phyto-ecological survey of the NWFP. F-Pu/BIO(28).	71,699.00	Dr. H.H. Naqvi, Botany Department, Peshawar University.
vii)	a) Palynological studies of the plants growing in Punjab. b) Seasonal variations in the frequencies of air borne pollen and spores which cause allergies and asthema with special reference to central Punjab. P-Pu/BIO(6).	1,17,710.00	Dr. S.M. Zahoor, Department of Botany, University of Punjab.

viii)	Survey of trace element in the soils of Sind Province and their effectiveness on the production of wheat, paddy and cotton. S-KU/BIO(36).	1,17,900.00	Dr. M. Ishaq Khan, Botany Department, University of Karachi.
ix)	Culturing of microalgae strains of produce animal feed for commercial exploitation. S-KU/BIO(47).	1,46,366.00	Dr. Jamil Ahmad, Department of Botany, University of Karachi.
x)	Annotated bibliography of fresh water food fishes of Pakistan. P-BIO(56).	23,802.00	Dr. Nazir Ahmad, 97-98 Old Rifle Range, Chauburgi Park, Lahore.
xi)	The culture collection of Algae of Pakistan at Sind University. S-SU/BIO(57).	2,03,056.00	Dr. Shahnawaz Arbani, Department of Fresh Water Biology, University of Sind.
xii)	Studies on glycoprotein hormones. C-IU/BIO(61).	4,87,636.00	Dr. M.H. Qazi, Department of Biological Sciences, Islamabad University.
xiii)	Studies on the mechanism of synthesis, release and regulation of human chorionic gonadotrophin in syncitio trophoblast cells of placenta. C-IU/BIO(62).	1,99,300.00	Dr. Mohammad Saleem, Department of Biological Sciences, Islamabad University.
3.	Chemical Sciences:		
i)	New calorimetric technique and measurement of heat of mixing of organic liquids. S-KU/CHEM(7).	57,885.00	Dr. Akhlaq Ahmad, Department of Applied Chemistry, University of Karachi.
ii)	Chemical investigations on plants materials of Sind. S-SU/CHEM(13).	1,10,345.00	Dr. Wadal Shah, Chemistry Department, University of Sind.
iii)	Production of single cell protein from industrial wastes. P-CISR/CHEM(49).	3,22,130.00	Dr. Yaqoob Chaudhry, PCSIR Laboratories, Lahore.
iv)	Structural and synthetic studies in their B Carboline Bases. S-KU/CHEM(10).	2,77,600.00	Dr. Salimuz-Zaman Siddiqi, Director, Post Graduate, Institute of Chemistry, University of Karachi.

v)	Biochemical studies on plants infected by parasitic nematodes. S-KU/CHEM(18).	1,37,104.00	Dr. Zainul Abedin, Professor, Department of Biochemistry, University of Karachi.
vi)	Structure of biopolymers & interaction of riboflavin with amino acids/proteins. S-KU/CHEM(26).	66,570.00	Dr.M.Abdul Haleem, Department of Biochemistry, University of Karachi.
vii)	Effect of germination on the nutritive value and digestibility of proteins and carbohydrates of grams and pea. S-CSIR/CHEM(40).	87,680.00	Dr. S.A. Warsi, PCSIR Laboratories, Karachi.
viii)	Infra Red studies of organic compounds. C-IU/CHEM(41).	1,34,515.00	Dr. Athar Yaseen Khan, Chemistry Department, University of Islamabad.
ix)	Use of activated clays for prevention of infestation in stored cereal gains. P-CSIR/CHEM(51).	78,975.00	Dr. S.M. Ali, PCSIR Laboratories, University of Punjab.
4.	Earth Sciences:		
i)	Terrain analysis and its application to urbanization. S-KU/Earth(4).	1,06,058.00	Dr. Syedain Zaidi, Geology Department, University of Karachi.
ii)	Exploration and evaluation of the economic mineral potentials and deposits of Nagar Parkar area, Southern Sind. S-SU/Earth(5).	2,61,100.00	Dr. Rais Ahmad, Geology Department, Sind University.
iii)	Land forms and soil parent material of the Khattak Foot-hills, Peshawar Valley, F-PU/Earth(15).	24,470.00	Dr. Mohammad Said, Gegraphy Department, Peshawar University
5.	Engineering Sciences:		
i)	Design and manufacture of hydraulic turbines in Pakistan. P-EU/ENG(7).	35,000.00	Dr. M. Ikram, Department of Mechanical Engineer-ing & Technology, Lahore

6.	Mathematics & Computing Activities:		
i)	Up-grading of Computer Centre Facilities. C-IU/MATH(6).	1,00,000.00	Computer Centre, University of Islamabad.
7.	Medical Sciences:		
i)	Hypoglycaemic and Pharmacological studies on indigenous anti-diabetic plants. F-KMC/MED(8)	39,275.00	Dr.S.A. Wahid Shah, Professor and Head Deptt: of Pharmacology and therapeutics, Khyber Medical College, Peshawar.
ii)	Bacteriological studies of Tuberculosis. P/MH/MED(19).	20,000.00	Dr. Salman H. Siddique, Incharge T.B. Research Unit, Institute of TB and Chese Diseases. Mayo Hospital, Lahore.
iii)	Effect of protein Calorie malnutrition and anemia in young children on their immune response. S/JPMC/MED(21).	25,000.00	Dr. Javid A.Hashmi, Pakistan Medical Research Council, Karachi.
iv)	Epidemiological study on viral hepatitis(Icteric and Anicteric) in the Industrial population of Karachi. S-JPMC/MED(22).	45,000.00	Dr. Sarwar Jehan Zuberi, Incharge, Research Cell, Jinnah Post Graduate Medical Centre, Karachi.
v)	Virological, Serological and electron microscopic studies on hepatitis in Rawalpindi and Islamabad areas. C/NHL/MED(24).	19,898.00	Col. M.I. Burney, Director, National Health Laboratories, Islamabad.
vi)	Role of arthopod borne viruses in human diseases in Pakistan. C/NHL/MED(25).	16,898.00	Col. M.I. Burney, Director, National Health Laboratories, Islamabad.

vii)	Study of streptococcal infection Rheumatic fever and Rheumatic heart disease in Rawalpindi and Islamabad. C-NHL/MED(26).	20,000.00	Dr. Abdul Ghafoor, Senior Scientific Officer, Biological Production Division, National Health Laboratories, Islamabad.
8.	Physical Sciences:		
i)	Fundamental and applied research in experimental solid state physics at and below room temperature. S-KU/PHY(5).	5,14,855.00	Dr. S.M.A. Tirmizi, Department of Physics, University of Karachi, Karachi.

9.	Utilization of Research Results:		
i)	(a) Prototype plant for utilization of discarded Banana plants for the preparation of pulp suitable for paper making. (b) Prototype plant for the production of Bio-gas in Sind region. PSF/UTZ/3 (2).	10.000.00	Dr. N. Naqvi, University of Sind, Jamshoro.
ii)	Prototype plant for the production of Bio-gas. PSF/UTZ/3(2).	5,000.00	Dr. Shehzad Sadiq, Energy Advisor to the Government and Project Director, Energy Resources Cell, Islamabad.
iii)	Use of Bio-gas operating prototype gas engines in rural areas for pumping water. PSF/UTZ/3(3).	12,200.00	Mr. I.H. Shah, Chairman, Mechanical Engg: Department, Peshawar University
iv)	Prototype Electric power generator utilizing water wheels in select areas of NWFP. PSF/UTZ/4(1).	9,900.00	Dr. M. Abdullah, Chairman, Electrical Engineering Department. Peshawar University.
v)	Utilization of Solar Energy for small scale applications, such as water and space Heating, regrigeration & improvement of water quality. PSF/UTZ/5(1).	30,080.00	Mr. I.H. Shah, Chairman, Deptt:Mechanical Engineering, Peshawar University.
vi)	Plantation of grain sorghum hybrid with small farmers. PSF/UTZ/7(1).	25,000.00	Dr. A.G. Bhatti, Maize Development Manager, Rafhan Maize Products Co. Ltd., Lyallpur.
vii)	Corriedale sheep. PSF/UTZ/8(1).	2,30,000.00	Mr. S.M.Naqi Haider, Director, Livestock Farms, Lahore, Punjab.
viii)	Production of Hybrid Sorghum seed from Foundation stock. PSF/UTZ/9(1).	3,00,000.00	Chairman, Department of Mech: Engineering, Peshawar University.
	Total:	6,12,180.00	

Annexure - IV

B) GRANTS SANCTIONED FOR SCIENTIFIC SOCIETIES AND LEARNED BODIES FOR ACHIEVEMENT OF THEIR OBJECTIVES:

No.	Agency	Grant in Rupees
1.	Pakistan Association for the Advancement of Sciences.	30,000.00
2.	Pakistan Scientific Society	50,000.00
3.	Pakistan Academy of Sciences.	2,00,000.00
4.	Pakistan Institute of Chemical Engineers.	10,000.00
5.	Sind Science Society	30,000.00
6.	Northern Areas Scientific Society	10,000.00
7.	Zoological Society of Pakistan	10,000.00
8.	Pakistan Botanical Society	10,000.00
9.	Society for the Advancement of Agricultural Sciences.	10,000.00
10.	Society for the Advancement of Animal Sciences.	10,000.00
11.	Pakistan Medical Association	20,000.00
12.	Cancer Society of Pakistan	10,000.00
13.	Pakistan Association for Public Health Engineering	10,000.00
14.	Pakistan Mathematical Association	10,000.00
15.	The Pakistan Institute of Scientists and Scientific Professions.	40,000.00
16.	Pakistan Statistical Association	10,000.00
17.	Pakistan Society of Leather Technology	8,000.00
18.	Institute of Engineers Pakistan	50,000.00
	Total:	5,28,000/00

Annexure-V

GRANTS SANCTIONED FOR PUBLICATIONS PROGRAMME

No.	Agency	Grant in Rupees:
1.	Pakistan Scientific Society	30,000.00
2.	Sind Science Society	10,000.00
3.	Zoological Society of Pakistan	5,000.00
4.	Pakistan Botanical Society	5,000.00
5.	Society for the advancement of Animal Sciences.	1,579.00
6.	Pakistan Medical Association	10,000.00
7.	Journal of Natural Science and Mathematics.	1,500.00
8.	Biological Society of Pakistan	6,200.00
	Total:	82,779/00

Annexure - VI

GRANTS SANCTIONED FOR ORGANIZING SCIENCE CONFERENCE/SYMPOSIA/SEMINAR

No.	Agency	Object	Amount
1.	University of Agriculture, Lyallpur.	Annual Science Conference of the Scientific Society	30,000.00
2.	Karachi University	International Conference on Mathematical Sciences.	50,000.00
3.	Pakistan Medical Research Council.	Seminar on "Application of Statistical Methods in Medical Research"	17,500.00
4.	Irrigation Drainage and Flood Control Research Council, Rawalpindi.	National Symposium "HYDROLOGY" with emphasis on flood control.	15,000.00
5.	Ministry of Presidential Affairs, Town Planning & Agrovilles Division.	National Seminar on "Ecology Environment and Afforestation".	5,000.00
6.	University of Islamabad.	Seminar on Computer Science.	5,000.00
7.	University of Engineering and Technology, Lahore.	National Seminar	2,000.00
8.	National Science Council	Science Policy Seminar	50,000.00
9.	University of Karachi	Seminar on Human and Natural Environment of Sind.	1,500.00
10.	University of Peshawar.	Human Environment in Pakistan World Environment Day 5th June.	1,500.00
11.	University of Baluchistan, Quetta.	Development and Human Environment in Baluchistan.	1,500.00
12.	University of Sind, Jamshoro.	Environment Day June, 1975.	1,500.00

No.	Agency	Object	Amount
13.	PASTIC	Seminar cum Workshop on Scientific and Technological information.	5,000.00
14.	University of Engineering and Technology, Lahore.	International Conference on Water-logging and Salinity.	20,000.00
15.	University of Engineering and Technology, Lahore.	International Conference Mechanical Engineering.	10,000.00
		Total:	2,15,500/00

Annexure VII

TRAVEL GRANTS FOR VISITS ABROAD

No.	Name and Address	Institution to to be visited:	Purpose of Visit.	Amount Sanctioned
1.	Dr. N.M. Tirmizi, Karachi University.	Natural History Museums in Europe USA, Japan.	Study tour for three months.	26,267/00
2.	Dr. Razia J. Rahmitoola, Jinnah Post Graduate Medical Centre, Karachi.	Bounes Aires, Argentina.	To participate in the XIV international Congress of Paediatrics.	24,070/00
3.	Dr. M. Nawaz Tariq Institute of Public Health Engg. & Research, University of Engg. & Technology, Lahore.	1. Paris 2. Birminghum University, Birminghum.	To participate in the conference on water pollution research.	9,822/00
4.	Dr. Kalifa Saeed-uddin, University of Engineering & Technology, Lahore.	University of New South Wales Australia.	To attend and read a paper in the "Australian conference on Engineering Material" 1st week of August, 1974.	12,000/00
5.	Dr. Zaheer M. Khan, Defence Science Laboratories, Karachi.	Tasmania, Australia	Post Doctoral fellowship for Research on Australian Poisonous Plants.	12,000/00
6.	Dr. Abdul Hussain Shah, Physics Department, Sind University, Jamshoro.	London, England.	To attend conference on Circuit Theory and Design, 23-26 July,1974.	10,836/00
7.	Mr. Mohammad Ashraf, PCSIR Laboratories, Lahore.	Technical University Institute for Minerology, Berlin,Germany.	To read a paper in the International Minerological Association at Berlin -September, 1974.	9,000/00
8.	Dr. Ahmad Mohiuddin, Zoology Department, Sind University	Munich, West Germany	To participate in the 3rd International Congress of Parasitology, August, 1974.	9,000/00

9.	Dr. A.H. Akhtar, Central Government Hospital, Rawalpindi.	Bounes Aires, Argentina.	7th World Congress of Cardiology, 1-7th Sept' 1974.	27,268/00
10.	Dr. Raffat H. Jaffari, Zoology Department, Punjab University, Lahore.	The Hague, Netherlands.	1st International Congress on Ecology 8-14 Sept' 1974.	1,962/00
11.	Dr. Salimuzzaman Siddiqui, Post Graduate Institute of Chemistry, University of Karachi.	Frankfurt, Germany.	Visit of Federal Republic of Germany, September, 1974.	8,104/00
12.	Dr. Kazi Ainuddin, Electrical Engineering Department, University of Engineering and Technology, Lahore.	Detroit and Miami, USA.	IX World Energy Conference and IEEE Joint Power Conference 23-27 Sept' 1974.	17,853/00
13.	Dr. N.M. Talpur, Professor, Department of Mathematics, University of Sind, Jamshoro.	British Museums/ Imperial College of Science and Technology.	To discuss the administrative problems of Museums.	2,790/00
			Total:	1,70,972/00

Annexure - VIII

List of Research Projects sanctioned during the year 1973-74

A. Projects which were implemented during the report period and whose annual reports have been received:

S-KU/OCEAN(2)	Studies on settlement and control of marine organisms in cooling systems of coastal installations.
S-KU/BIO(52)	Marine Molluscs of Pakistan.
C-IU/CHEM(14)	Studies in thermodynamics of interaction of solid catalysts with gases, liquids and vapours.
S-SU/CHEM(30)	Chemical analysis and utilization of certain sub-standard or uneconomic minerals and ores of Pakistan.
S-KU/CHEM(44)	Chemical composition of hair-root as a criterion of protein malnutrition.
S-KU/CHEM(46)	Cell and tissue culture research.
S-KU/PHY(3)	Electronic spectra of metallic hydrides.
P-PU/PHY(11)	High Energy Phenomenology.

B. Projects which remained in progress for short periods:

P-PU/BIO(5)	Morphophysiological effects of gamma irradiation on growth and yield of Agricultural crops.
S-SU/BIO(35)	Palynological studies of plants growing in Sind region.
P-PU/BIO(50)	Survey and collection of diseases of silkworm in Punjab, NWFP and Azad Kashmir.
S-KU/BIO(53)	Anatomical Studies of Mantis shrimp.
F-PU/CHEM(19)	Chemical analysis of minerals for their commercial exploitation.
F-PU/CHEM(22)	Models for phosphate linkages.
F-PU/CHEM(38)	Influence of ligand structure on the Co-ordination properties and reactivity of transition metals.

P/TC/PHY(9)	To investigate momentum distribution of nucleons inside the nuclei of light elements of emulsion using nuclear emulsion techniques.
P-PU/PHY(12)	Properties of dielectrics at microwave frequencies.
P-NIAB/AGR(16)	Synthesis of improved wheat genotypes based on the development of criteria involving physiological analysis.
P-EU/ENG(9)	The photogrammetric measurement of constructional displacement of Tarbela Dam.
C-IU/MATH(7)	Study of MHD and Plasma Physics.
B-BU/EARTH(10)	Exploration of flourite deposits in Kalat Division, Fort Sandeman and Dir.
C-NHL/MED(11)	Studies for the development of a vaccine for trachoma.

C. Projects which could not be initiated during the report period:

P-AU/BIO(22)	Ecopathological studies in plantation and Natural Forests in Punjab.
S-SU/BIO(31)	Studies on the Taxonomy, incidence, seasonal fluctuations and ecology of the parasites of Fresh Water Fishes of Kinjar Lake.
P-AU/BIO(38)	Collection and study of Fish Fauna of Pakistan.
P-AU/BIO(40)	Ecology of some avian and mammalian pests.

Annexure - IX

Date of Meeting	Visitor
2.7.1974	Dr. V.G. Podoinitsin, Director, Regional Science Office, UNESCO.
24.10.1974	Dr. Willis R. Brewer, Dean, Professor, Pharmacognasist, College of Pharmacy Arizona, ARIZONA.
13.11.1974	Dr. V.G. Podoinitsin, Director, Regional Science Office, UNESCO.
10.12.1974	Chinese Scientists' Delegation: i) Mr. Kuo Pei-Shan, Chairman, Revolutionary Committee, Institute of Physics, Chinese Academy of Sciences. ii) Madam Li Chih-Feen, Head of Synthesization Department, Institute of Chemistry, Chinese Academy of Sciences. iii) Mr. Chia Sheu-Chuan, Head of Crystal Growth Department, Institute of Physics, Chinese Academy of Sciences. iv) Mr. KU Pin-Yuan, Head of Fodder Department, Institute of Microbiology, Chinese Academy of Sciences. v) Mr. Kao Chin-Tien, Head of Research Department, (Sorghum, Hybrid Corn and Wheat) Institute of Genetics, Chinese Academy of Sciences. vi) Mr. Lu Hui-Sheng, Deputy Head, Foreign Affairs Bureau, Chinese Academy of Sciences.

	vii) Madam Wu Ling-An, Inspector, (Research Worker), Scientific Research Department, Institute of Physics, Chinese Academy of Sciences.
23.12.1974	Mr. R.R. Ronkin, National Science Foundation, U.S.A.
	Mr. G.A. Edwards, Programme Manager, Special Foreign Currency Programme, National Science Foundation, U.S.A.
24.1.1975	Mr. Hansen, United Nations Environmental Expert
11.2.1975	Shahzada Saeed-ur-Rashid Abbasi, Minister of State for Science and Technology.
1.3.1975	Dr. J. Juan Spillett, Assistant Leader, Utah Coop: Wildlife Research Unit, Utan State University, Logan, Utah 84322
5.3.1975	Dr. Ijlal Haider Zaidi, Resident and Commissioner, Northern Areas, Gilgit.
27.3.1975	Dr. Lynch, British Council Expert on Science and Technology Information.
	Dr. Leroy Makepeace, Coordinator, Smith-Sonian Institute, U.S.A.
16.4.1975	Mr. Oakeley, UNDP Expert.
	Dr. Metzner, Regional Rep. Department of Health, Education and Welfare, U.S.A.
22.4.1975	Mr. Cornelle Jest (UNDP) UNESCO Consultant Acting on Mountain Eco-Systems.

28.4.1975	Dr. Gerald Edward, National Science Foundation, U.S.A.
30.4.1975	Mr. P. Strans, Expert Medica.
8.5.1975	Dr. Salim-uz-Zaman Siddiqi, Acting Vice-Chancellor, University of Karachi, KARACHI.
12.5.1975	Dr. A.H. Qureshi, University of Engineering and Technology, Lahore.
13.5.1975	Professor Tahir Kheli, University of Peshawar, PESHAWAR.
26.5.1975	Mr. Graham Jones, UNESCO Expert.
29.5.1975	Dr. Ray Horn, UNESCO Consultant on Environment Education.