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RE-ORIENTATION OF POSIB LABORATORIES^{1/}

PAKISTAN.

(DP/PAK/14/031)

Terminal report .

Prepared for the Government of Pakistan by
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I. SUMMARY

It is proposed that the initial effort to reorganize the laboratories of the Pakistan Council of Scientific and Industrial Research (PCSIR) concentrate on the formation of five mono-functional institutes as follows:

Institute of Nutrition and Food Technology to act principally in the areas of food preservation and recovery of potentially nutritious wastes.

Institute of Minerals Technology to act in the areas of ore characterization, beneficiation and extraction.

Institute of Glass and Ceramics to act in the areas of glass and ceramics products, including refractories. Due to equipment similarities, metallurgy may be a temporary section of this institute.

Institute of Oils, Fats and Waxes to act in the areas of extraction, purification and modifications of these materials for both industrial and food uses.

Institute of Agro-Industrial Chemicals to act in industrial areas not otherwise covered, particularly in the prevention and/or usage of industrial wastes and in development of processes for specialty industrial products requiring relatively large amounts of foreign exchange. Pilot plant design activities will initially be incorporated in this institute.

To serve these institutes, centralized service organizations are proposed to be set up as follows:

Economic Evaluation Section to analyze the viability of

Research and Development (R & D) projects.

Liaison Section to contact outside industrial and government

organizations to sell ICSIR's services and to provide input and feedback to the institutes.

Instrument and Fine Machine Repair Shop to serve outside

industry and government organizations as well as ICSIR.

Analytical Section to provide high quality analytical service

to all institutes and permit the most efficient use of the more costly instruments.

In addition, it is proposed that Library and Machine Shop operations each be placed under one head with the objective of building up first class facilities with a minimum of duplication, while still providing good service to ICSIR as a whole.

It is recommended that ICSIR aim toward consolidation of all its activities on one site as a long-range objective, and that this objective be kept in mind during formation of the present institutes.

Details of the procedures recommended to accomplish the above are to be found in the UNIDO Project Document DP/PAK/75/ which this report supplements. A three-year period is allotted for completion of the work.

II. BACKGROUND

History of the ICSIR laboratories is adequately covered by the associated Project Document and various previous reports, and will not be reported here, except to state that the laboratory reorganization concept involves the establishment of a number of mono-functional

institutes to replace a departmentalized system operated essentially independently, at three separate laboratory locations (Karachi, Lahore and Peshawar), with overall administration by the Council from Islamabad.

Job Description Duties

The following is taken from UNIDO's Job Description DF/PAK/031/11-01/08

"The expert will prepare in co-operation with UNIDO staff member and the Senior Industrial Development Field Adviser a project document on the basis of which a large scale assistance will be given to PCSIR. In particular the expert will specify tasks which will have to be accomplished by the large scale project to achieve:

1. functional re-organization of the laboratories;
2. introduction of up-to-date management practices;
3. introduction of new concepts of financing technical development such as introduction of the concept of development contracts and similar innovation practices;
4. program of priorities for development of products and design capabilities in harmony with techno-economic parameters of the Pakistan national economy;
5. advise on the extent and duration of the technical assistance that will be required from UNDP in the near future;
6. propose a composition of the team of experts for the large scale project;
7. propose a composition of the team of counterparts;
8. draft corresponding job descriptions;
9. prepare budgetary estimates."

The Project Document has been prepared by UNIDO staff member

Mr. Y. Prokhorov and the writer with the assistance of Mr. J. Skoumal, Senior Industrial Development Field Adviser in Pakistan. All items

of the Job Description have been completed. The thinking reflected in this supplementary report forms much of the basis for the Project Document, and the two reports should be read in conjunction with each other.

III. REPORT OBJECTIVES

This supplementary report has two objectives:

1. To provide background information for the Project Manager and team of international experts and counterparts who execute the project, and
2. To elucidate the basis for the Project Document in greater detail than the form of that document permits.

IV. FINDINGS

PCSIR has a number of highly trained and enthusiastic scientists on its staff who can form the nucleus for administering a really effective organization. Space appears to be adequate for most of the plans, and equipment and instruments, while inadequate and in some cases obsolete, do exist and are operated under the supervision of skilled personnel, who show great ingenuity in making repairs and in improvisation.

The laboratory shops have only basic machine tools, but use them very well. Shop capability is especially important to PCSIR, since purchase of mechanical items is often time consuming and requires foreign exchange, and since the nature of the PCSIR program involves development of mechanical items not on the general market. Outside shops are available in Lahore and Karachi for contract work beyond the laboratory capability, but the laboratories can increase efficiency with additional shop tools.

PCSIR has a backlog of projects, some of which are close to the development stage, lacking, in some cases, only the means of implementation and evaluation to establish their worth.

PCSIR has been successful in aiding and starting very small and cottage-type industries. While these areas are outside the scope of the proposed UNIDO project, their importance should not be overlooked. While no single project of this nature is apt to have great impact, the overall effort may well be significant. This facet of the PCSIR program should be kept in mind in any reorganization.

PCSIR salaries are lower than the industrial scale by as much as one-third. As a result, trained people tend to leave as soon as their 5-year bond expires and/or they receive an outside offer.

In spite of low salaries and relatively high costs for equipment and supplies, salaries make up over 75% of the PCSIR budget. The writer estimates that this figure should be closer to 50% (say 55%) for a proper balance at present salary levels. This means that either (a) the annual budget should be increased for maximum results, or (b) the staff can be selectively reduced with little loss in present research accomplishments.

Of approximately 600 scientists and technologists in PCSIR, there are to date only about 15 engineers in the entire organization. A better ratio would be about 4 scientists (Ph.D and M.S. in Pakistan) to one engineer of similar education level.

The laboratories, in some instances, have work in the same general area divided between two or three widely separated locations. Work of this type is coordinated by a "Convener", whose primary function is to see that duplication does not occur. The work itself, however, is generally locally directed.

There are some people in the laboratories who are unqualified, due either to inadequate training or to work attitude.

Morale is generally poor in the laboratories, owing not only to salary inequities as compared to industry, the presence of non-producers drawing the same pay, and the paucity of research funds, but perhaps more importantly, the lack of sufficient opportunity for advancement as a result of good, hard, successful work. This situation is to be expected to some extent in a static-budget situation, but the problem of adequately rewarding highly trained and intelligent personnel in non-administrative posts is especially serious in R & D organizations.

Purchase and delivery delays are a handicap to ICSIR's efficiency. Such delays sometimes require that a project be completely stopped pending receipt of the needed item. Not only is momentum for the given project lost, but the scientist must have alternate project(s) to work on. This results in a relatively large number of research projects of varying degrees of importance, and on occasion, inordinate time-of-completion requirements.

Compared to an industrial R & D organization, ICSIR operates in a virtual vacuum, and its role is in some instances unclear. The scientist must sometimes conceive, plan, execute, and implement his project, with little or no outside input or feedback. There are some 20 other government agencies with which ICSIR might logically be expected to interact directly, and clarification of the role of each would be most helpful.

Economic evaluation of R & D projects needs to be extended. ICSIR has made a good start in acquiring project evaluation techniques through a U.S. Aid program working with the Denver Research Institute,

and this program should be considered along with the UNIDO project. This linkage of PCSIR with another R & D institute is an interesting concept that should prove useful. The National Research Council of Canada also has recently indicated some interest in establishing a relationship with PCSIR in the field of Oils and Fats.

A serious weakness in the overall industrial development set-up is the lack of facilities to convert pilot plant data into a commercial plant. PCSIR can do this on a small scale, but commercialization of anything of significant size is generally outside the scope and capability of an R & D organization. It is understood that the Industrial Process Design Center under the Ministry of Production has been set up to do this, but the Center is reportedly greatly understaffed. At present, any significant pilot plant development would probably have to be handled by a foreign engineering-construction firm.

Library and information service appears to be only fair, although improvements continue to be made as funds become available.

Safety practices are generally not up to U.S. standards for an R & D operation.

V. DISCUSSION

The concept of mono-functional institutes implies three important changes in PCSIR. First, it separates and unifies the direction of R & D done in specific areas, where under the present departmental system this work may be directed by as many as three individuals. Second, it virtually forces consolidation of work in a given area to one location, either eliminating or reducing to station status work in that area at other sites. Third, it strongly indicates the desirability of forming centralized service groups (analytical, shop, project evaluation, liaison, library, purchasing, accounting) located on one major site, making other sites secondary locations, since it

is obviously desirable to provide equal service facilities of the best possible quality for each independent institute.

It has become customary for major corporations to consolidate their R & D operations at one major location, even though their production and sales may be nation-wide, and the success and growth of intra-company research centers further attests to the desirability of R & D consolidation. If it were possible to start from scratch, the monetary advantages of locating PCSIR on one site are obvious. There would be one shop instead of three, one animal testing facility instead of three, one of several types of instruments instead of three, etc. This, plus the advantages of interdisciplinary interactions usually outweigh any advantages of having R & D close to a particular producing or consuming center. The location of pilot plants is in any case often dictated by availability of raw materials, rather than the location of the R & D facility itself.

Long range, therefore, PCSIR should aim toward a first-class facility on one site, with the general policy of having at least one of the most up-to-date applicable instruments, all of the pertinent technical journals and texts, adequate shop equipment for its needs, well-staffed and experienced service groups, etc. If it were financially practical to consolidate all PCSIR activities on one site as a part of the forthcoming UNIDO project, it would be wise to do so. However, the three locations exist and must doubtless be utilized. The exact method of doing so poses a complex problem, the resolution of which will require the first several months of the efforts of the UNIDO and counterpart team.

Organization

It will be wise to proceed in a step-wise fashion in implementing the mono-functional institute concept. Hence, for a time--perhaps indefinitely if those aspects of the PCSIR program not included in

the institute plan are continued--the departmental organization will continue to exist right along with the separate institutes. In any case, centralized services must be administered outside the institute managements, and an administrative head will always be needed at each site. As regards their programs, institute heads will report directly to PCSIR's top central management.

Staffing

Apart from the difficulties posed by multiple locations, the greatest immediate problem undoubtedly involves staffing the institutes, in view of the small number of people with engineering training available, and the lack of success in keeping those that have been hired. Steps should be taken soon to correct this situation, since any complete solution will be long range. The first step is to establish a realistic salary scale that takes into account supply and demand, as well as the time and work load requirements of the basic training. This means that, at present, engineers must be paid more than scientists at the same experience and degree level. This is not an unusual situation. The second step is to somehow increase the supply of engineers. Associate Professor Afzal H. Bandey, Chairman, Department of Chemical Engineering, University of Engineering & Technology, Lahore, was consulted regarding training present staff members holding masters' degrees in science in engineering fundamentals. It was agreed that a 2-year (either part time, full time, or night school) course leading to an engineering diploma is a practical approach. Toward this end, an in-country fellowship program might be considered. Since this program could be carried out with rupees rather than foreign exchange, it is not included in the proposed UNIDO

project. Obviously, hiring in the immediate future should generally be in the technical, rather than the scientific, sector.

Contract R & D by PCSIR

Contract R & D has been mentioned as a potential major approach for PCSIR. Successful contract R & D is primarily a selling job. Only a minimum amount of experimental R & D or survey work is done by most independent laboratories operated for profit until a customer for the proposal has been found, and staff is promptly laid off, keeping only a core of professionals, when sales drop off. Professionals receive higher salaries in this relatively insecure situation. Obviously, a strong project analysis team is a necessity, as is an aggressive liaison (sales) organization. Both these groups are included in the UNIDO project.

It is also necessary to provide services that potential customers need and desire. To this end, the UNIDO project includes a repair shop for electronic instruments and fine machines, to be equipped to serve industry and other government agencies as well as PCSIR. Capability to make market studies and surveys is also to be included. It is suggested that PCSIR propose regular analytical checks of the accuracy of control and quality tests made at production locations as a contract service.

In practice, PCSIR can operate only partially as an independent R & D shop. The larger industries, built with purchased know-how, rely on foreign technical assistance and they will be slow to change, even though it is most desirable that Pakistan become eventually independent of foreign technical aid. R & D service to production for operating plants is in any case not great as compared to service to Engineering during plant design and during plant start-up. In an

Industrial R & D organization, most R & D assistance is directed toward Sales, and involves improvement of product quality, development of new applications, product modification, customer service, etc. In a protected market situation, such as exists in Pakistan for larger industry, incentive for such R & D assistance to Sales does not exist. Manufacturers that operate in a competitive situation are better prospects for contract R & D.

Unfortunately, the smaller industries at present simply cannot afford fees that cover the R & D cost, and while a number of contracts have been obtained with small organizations, the charges are too small to have any appreciable effect on PCSIR's annual budget. There have been a few cases where larger industries have financed pilot plants (e.g., a pilot plant to develop use of local coal in coking blends, financed by Pak Steel Mills Corp.), but so far these have been exceptions.

Independent R & D organizations in the U.S. depend most heavily on government contracts, and PCSIR should press this approach. If, for example, PCSIR can interest the Ministry of Health in preliminary nutritional studies involving, say, fish waste, this Ministry may well be willing to finance the further development of the project, and additionally, to see that the results are properly implemented. This interaction with other government agencies would be most desirable, providing both input and implementation and a sense of real value and cooperation to the work. Similarly, such contracts with the Ministries of Industry and Production would apply to new larger industry. PCSIR has been particularly successful in its contract dealings with the Ministry of Defense (Airforce) in following this approach.

Centralized Liaison Section

The UNIDO project envisages establishment of a more aggressive liaison effort with outside organizations than now exists. The sole duties of this section will be to keep abreast of all activities in FCSIR and make frequent contact with outside groups to disseminate and acquire information with the goals of (a) establishing clearly FCSIR's place in the overall national scheme and (b) improving FCSIR's contribution in all possible ways, including contract R & D. A considerable amount of input is expected from this group in the way of knowledge of opportunities and problems that exist in industry and government.

Centralized Project Evaluation Section

This section will make economic studies of varying degrees of thoroughness (depending on the status of the project) and will be staffed with persons familiar with market study, estimating, costing and economic evaluation. It will serve and advise all institutes. An Industrial Economist is an important member of the initial UNIDO-counterpart team, and economic analyses of major projects within the initial scope of the institutes will be an important function, as well as setting up the subject section. Eventually, the section will contribute to the FCSIR program by making market surveys and economic studies that suggest R & D projects and which may themselves be salable.

It should be mentioned that not all R & D projects are to be subjected to economic evaluation. It frequently happens that less effort is involved in testing a promising idea experimentally for technical feasibility than in making a careful economic survey, in which case it is best to defer the latter until technical feasibility

has been established. A general rule is that 10-15% of an industrial laboratory's budget should be unspecified and reserved for in-house research without requirement for justification.

Centralized Analytical Section

Since the cost of providing separate analytical instruments to each separate institute becomes astronomical, it will be absolutely necessary to establish a central analytical department to serve all institutes. Such a centralized analytical group will also eliminate some jealousies and friction that are bound to exist when commonly-used instruments are assigned to specific departments. Establishment and organization of this analytical service and location of instruments is a major problem that must be solved by the UNIDO-counterpart team in the initial months of the project. In general, the functions of a central analytical section include routine analyses (which can sometimes be performed by high school graduates), analyses involving high priced equipment not used sufficiently often by one institute to justify purchase, analysis requiring expert knowledge and techniques, and development of new analytical methods. Instruments and/or analytical personnel may also on occasion be assigned from the analytical section to institutes for specific projects on a temporary basis.

Centralized Library

There are advantages in placing all library operations under one head, particularly if a program is inaugurated of advising principle scientists of publications received in their field(s) of interest. The UNIDO project envisages provision of a short-term expert in technical information to aid in organizing a more comprehensive and centralized service, and to work closely with the Information Center (PANSDOC), established under the Pakistan Science Foundation, in

improving, if possible, the time lag in receipt of information from this source.

Each institute will have its own library or library section, but literature purchases and distribution will be under one technical librarian head. A complete set of library cards and listing of journals will be placed at each of the three laboratory sites. Eventually, the central library organization will provide literature searches at the request of scientists.

Centralized Shop

Shop activities are already centralized to a considerable degree. The UNIDO program would make one man responsible for recommending all shop purchases, with the aim of building up one first class facility available to all, and providing other locations only the basic equipment. This is proposed primarily to keep the cost of shop equipment as low as practical--and still have adequate facilities available to the entire organization. Mechanics would be assigned from a central pool to institutes as needed on both temporary and permanent bases.

Instrument and Fine Machine Repair Shop

This service, needed by FCSIR itself, also will be designed to serve industry and other government agencies as well. Not only is a service provided, but an entree leading to other contracts is expected to result. The initial UNIDO team includes experts in these fields.

Pilot Plant Design and Operation

In the initial planning documents, pilot plant organizations are specified for each institute in nearly every case. This is generally a sound principle, since pilot plant personnel should work with

scientists from the inception of a project to its finish. Also, at least as many, often more, ideas pertaining to industry will originate from an engineering group than from a scientific group. The difficulty lies in the fact that the needed engineers are simply not available, and will not be for some time to come. Therefore, it appears necessary initially to centralize pilot plant design activities (as well as shop facilities) and provide them as a service when needed by each institute. Later, it is hoped that the engineering staff of each institute can be built up independently, and will both operate and design equipment used by the institutes. Equipment regularly used by an institute, even though of pilot plant scale and designed by a separate pilot plant group, should be in any case operated in cooperation with the institute staff.

Initial Equipping of the Institutes

In general, present institute plans are quite broadly written and require large expenditures for equipment and instruments to perform all the possible activities listed. A better approach is to choose several projects of established worth and equip initially for these (plus the services to be provided), adding facilities as new projects develop and experience is obtained. This will not only spread expenditures over a longer period, but will assure the purchase of useful equipment for the situation existing in Pakistan and a productive program from the beginning.

If the institutes are to achieve the goals desired, it is important that their projects be such that technical success will have significant impact. Choosing these specific initial projects will therefore require careful preliminary economic study, which is a major initial function of the UNIDO-counterpart team. Following

the initial choice of major projects to be undertaken by each institute, it will be necessary to compile detailed lists of all equipment, instruments and supplies needed for each project, including name of manufacturer, model number, quantity and price, as well as design sketches and material requirements for items to be locally fabricated. Short-term experts, as yet unspecified, will give assistance in these tasks.

Obviously, any of the above work done in advance of the UNIDO project by ICSIR personnel will shorten the period of the initial study and assure completion of the institutes within the three-year period visualized.

Counterparts and Fellowships

At least one counterpart for each UNIDO expert should be supplied by the Council.

Fellowships should involve practical, intensive training in institutes established elsewhere and/or in industry. Persons with engineering training (possibly supplemental engineering training) should be given preference in granting fellowships.

Short Term Experts

Certain of the short term experts (Technical Information--3 months; Pharmaceutical Screening--3 months; and Instrumental Analysis--6 months) should be scheduled during the initial 6-month study period along with the long-term experts. Following the initial study period, the Project Manager will specify other short-term experts as the precise need is determined.

VI. INSTITUTE PRIORITIES

Rather than attempt to equip and staff all of the mono-functional institutes planned at once, it is believed more practical to begin

with a relatively small number, and it is therefore necessary to establish priorities in executing the UNIDO project. To this end, "first order" and "second order" priorities have been assigned, taking into account use of local raw materials, relative impact on the economy, state of the local technology, and cost and time involved in setting up the particular institute. Assignment of a "second order" priority by no means implies that an institute will be eliminated--merely that it will come along later in the overall plan, provided, of course, that funds are available. Certain of the 16 listed institutes are in a very preliminary planning stage and may not be a part of PCSIR; these are so listed. All priorities are of course subject to revision by the Council.

INSTITUTES WITH FIRST ORDER PRIORITY

1. Institute of Nutrition and Food Technology

There is undoubtedly great potential in food processing and preservation, and it is proposed to implement this institute plan. The field of nutrition is considered outside UNIDO's scope, and plans in this area are to be developed independently by PCSIR. It is proposed that the utilization of oils and fats as foods be eliminated from this institute and incorporated in the Institute for Oils, Fats and Waxes, since manufacture and treatment of these materials for food and industry are similar.

2. Institute of Minerals Technology

There is much activity in Pakistan in this area, and it is thought that this is one of the first institutes needed. It is proposed to be implemented in the UNIDO project. Emphasis will probably be on characterization, beneficiation

and extraction.

3. Institute of Glass and Ceramics

This institute is also proposed to be implemented. In particular, there appears to be potential in refractory manufacture as well as glass and clay products. Since the high temperature furnaces and a number of the instruments needed for glass and ceramics can also be used in metallurgical studies and development, it might be considered to include this area in this institute temporarily. Later, the metallurgical section could become an institute in its own right, and branch out to include welding, smelting and foundry practice. Such decisions are wholly in the province of the Council, however.

4. Institute of Agro-Industrial Chemicals

This is a general purpose institute of too broad a scope to equip in one specific way. It is visualized that the requirements of this institute will continually change, and that equipment will be acquired gradually as needed. Some, of course, is now available.

It is suggested that the Institute of Pilot Plant Design and Development initially be incorporated into this institute to provide the close relationships needed between scientists and engineers, and in view of the small number of engineers now available. This incorporation would also tend to integrate the Agro-Industrial Institute with institutes working in related fields.

5. Institute of Pilot Plant Design and Development

A centralized pilot plant group is needed under the present circumstances, and is included as part of the Institute of Agro-Industrial Chemicals (see above). However, as noted in an earlier paragraph, it is believed that each institute should eventually have its own pilot plant (engineering) section, with access to centralized shop and fabrication services. The proposed UNIDO project makes provision for such shop facilities.

An engineering group devoted wholly to improvement in known process design seems far in the future.

6. Institute of Oils, Fats and Waxes

This institute is given first order priority, because its activities involve use of local raw materials and local markets exist.

7. Institute of Leather Technology

This institute is already underway under a separate aid program, and is not included in the proposed UNIDO plan. However, centralized services may be made available to it, even though it is not a part of PCSIR.

INSTITUTES WITH SECOND ORDER PRIORITY

8. Institute of Pharmaceuticals and Fine Chemicals Technology

Decision regarding the nature of implementation of this institute in the UNIDO plan is proposed to be deferred, pending resolution of questions regarding the viability of parts of the program. This requires some

explanation. Much of the program now involves testing the biological activity of extracts made from herbal (folklore) medicines still widely used in Pakistan. These extracts, even when made from materials regarded as foodstuffs, cannot be assumed to be non-toxic, and ICSIR's facilities and staff for testing toxicity and side effects of drugs to be used on human beings are inadequate. Further, it is doubtful that the extent of the effort and the likelihood of success can justify the tremendous expense of installing and staffing an adequate drug screening facility. A better approach, if extracts are to be made, may be to contract for pharmaceutical screening with established drug houses, retaining the Pakistan rights plus a small royalty, from sales elsewhere, should a useful drug be discovered. Such contracting can usually be done at no cost to the supplier, but chances of success are small.

In view of the wide local use of folklore medicines by human beings, it is certainly in order to systematically study their efficacy. However, since animals do not necessarily react as do human beings, the testing of the herbal medicines themselves (not extracts) on animals seems superfluous, when human beings are actually using these folklore medicines and can themselves be studied. This approach, however, is a medical one and would appear to be outside the scope of the UNIDO project.

The proposed UNIDO project includes provision of a short-term pharmaceutical screening expert in the initial group to objectively consider all aspects of the

pharmaceutical program and recommend a course of action. It is anticipated that efforts toward development of known drugs from Pakistan materials will continue if economically justified, but it is believed best to make no decision regarding this institute until program plans are resolved.

Decision whether to follow the program outlined above rests, of course, with the Council.

9. Institute of Fuel Technology

This institute involves only the study of coal (not hydrocarbons), and a pilot plant, wholly financed by Pak Steel Mills Corp., for investigation of the blending of indigenous coal with imported coal for coking purposes is underway, as has been previously mentioned. In general, however, the local coal so far discovered is of very poor quality. It is probably wise not to waste the limited available technical talent on too much investigation of very low grade raw materials, and it is therefore suggested that the Council defer implementation of this institute, although eventually even low-grade coals will doubtless be in demand. This institute would in any case not be a part of PCSIR.

10. Institute of Textiles Technology

This institute is to deal primarily with wool, although some work is being done on jute, sisal, etc. An institute of textile technology involving cotton has been established with the aid of UNDP under the Ministry of Production. Since the cost of setting up a textile

institute to develop and serve a large weaving industry is so very great, it is suggested that this institute be given a second order of priority, particularly since it may eventually be incorporated into the cotton facility, and since useful experience with the cotton facility is still being obtained.

11. Institute of Applied Biology

It is suggested that this institute be given a second order of priority, largely because its projects are relatively long range and generally not as far along as those mentioned earlier. The Institute of Nutrition and Food Technology must of course have people with micro-biological skills and experience in carrying out its projects.

INSTITUTES AND LABORATORIES IN INITIAL PLANNING STAGES

12. National Standards Laboratory

The requirements of this laboratory will be largely met, in that the proposed UNIDO project provides for a centralized analytical service designed to serve both PCSIR and industry, along with a centralized instrument and fine machine repair shop, also designed to serve both industry and PCSIR. It would appear that the Laboratory of Weights and Measures under the Ministry of Industry would be responsible for standards outside PCSIR.

13. National Engineering Laboratories

This is understood to be a proposed training center in the field of optics and precision measurements, outside the scope of the UNIDO project, and probably not a part of PCSIR.

14. National Institute of Electronics

It is at present not certain that this institute will be a part of PCSIR. It is an important institute, since the industry is in part labor-intensive. It would be given a second order of priority in the UNIDO project, because the only current application, now well satisfied, is that involving transistor radios, and further planning is still in the initial stages. It should be considered in the latter stages of the UNIDO proposal, if the institute is to be made a part of PCSIR.

15. National Institute of Solar Energy and Wind Power

To the writer's knowledge, as yet unplanned.

16. National Institute of Power

To the writer's knowledge, as yet unplanned.

VII. RECOMMENDATIONS

Specific actions for carrying out the proposed UNIDO project for the PCSIR are recommended in the Project Document which this report supplements. The reader is referred to this Document for this information. The following additional recommendations refer to actions to be considered by the Council prior to inauguration of

the proposed UNIDO project. It is recognized that some of these recommendations may be very difficult to carry out.

1. Prepare up-dated job descriptions of all PCSIR graded positions, and evaluate the performance of all employees against them.
2. Eliminate all sub-standard personnel, hopefully by transfer to other less-demanding government posts possibly by de-grading.
3. Increase salaries of qualified personnel to more closely correspond to the prevailing industrial scale. Re-grading of positions with high education requirements may be necessary to accomplish this.
4. Consider establishment of a scientific (non-administrative) ladder of advancement, thereby providing opportunity to reward (and keep) those outstanding scientists and engineers who do not wish to be in or who do not fit into management positions, or for whom management positions may not be currently available.
5. Investigate the feasibility of giving supplemental engineering training to scientists, and provide the necessary incentives.
6. Review all measures that might speed up purchase and delivery of equipment and supplies, since this is always a major factor in R & D efficiency. In particular, consider substantially increasing the

financial authority of the Laboratory Directors in making purchases within the scope of the approved budget.

VIII. APPENDIX

List of persons contacted during investigation (in chronological order):

- Dr. M.M. Qureshi, Member, National Science Council
- Mr. Ghulam Kibria, Consultant on Appropriate Technology Development,
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- Mr. Ashraf Ali, Liaison Officer, Karachi Laboratories, PCSIR
- Mr. M. Aslam, Director, Karachi Laboratories, PCSIR
- Dr. Shabbir Ahmad Qureshi, Head of Engineering Research Division,
Karachi Laboratories
- Dr. S.S. Rizvi, Principle Scientific Officer (PSO), Physics Division,
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- Dr. A. Haneed Khan, Head of Research Division, Food & Nutrition,
Karachi Laboratories, PCSIR
- Dr. A.H. Chotani, Director, Fuel & Leather Research Center, Karachi
- Dr. M. Arshad Ali Beg, PRO, Agro-Industrial Division, Karachi
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- Mr. Siddiqui, Principal, PakSwiss Training Center
- Mr. Kashif, Physicist, Lahore Laboratories, PCSIR
- Dr. Yusuf Ahmad, Director, Lahore Laboratories, PCSIR
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- Dr. S.E. Khan, FSO, Lahore Laboratories, PCSIR
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- Dr. Sheikh Naseeruddin, Scientists, Minerals & Metallurgy, Lahore
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- Dr. Muhammed Harrif Chandry, SRO, National Standards Laboratory,
Lahore Laboratories, PCSIR
- Dr. Ali Ehsan, SRO, Agro-Industrial Chemicals Division, Industrial
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- Dr. Riaz Ali Shah, Director, Peshawar Laboratories, PCSIR
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**Dr. M. Akram Khattak, P30, Minerals Research Division, Peshawar
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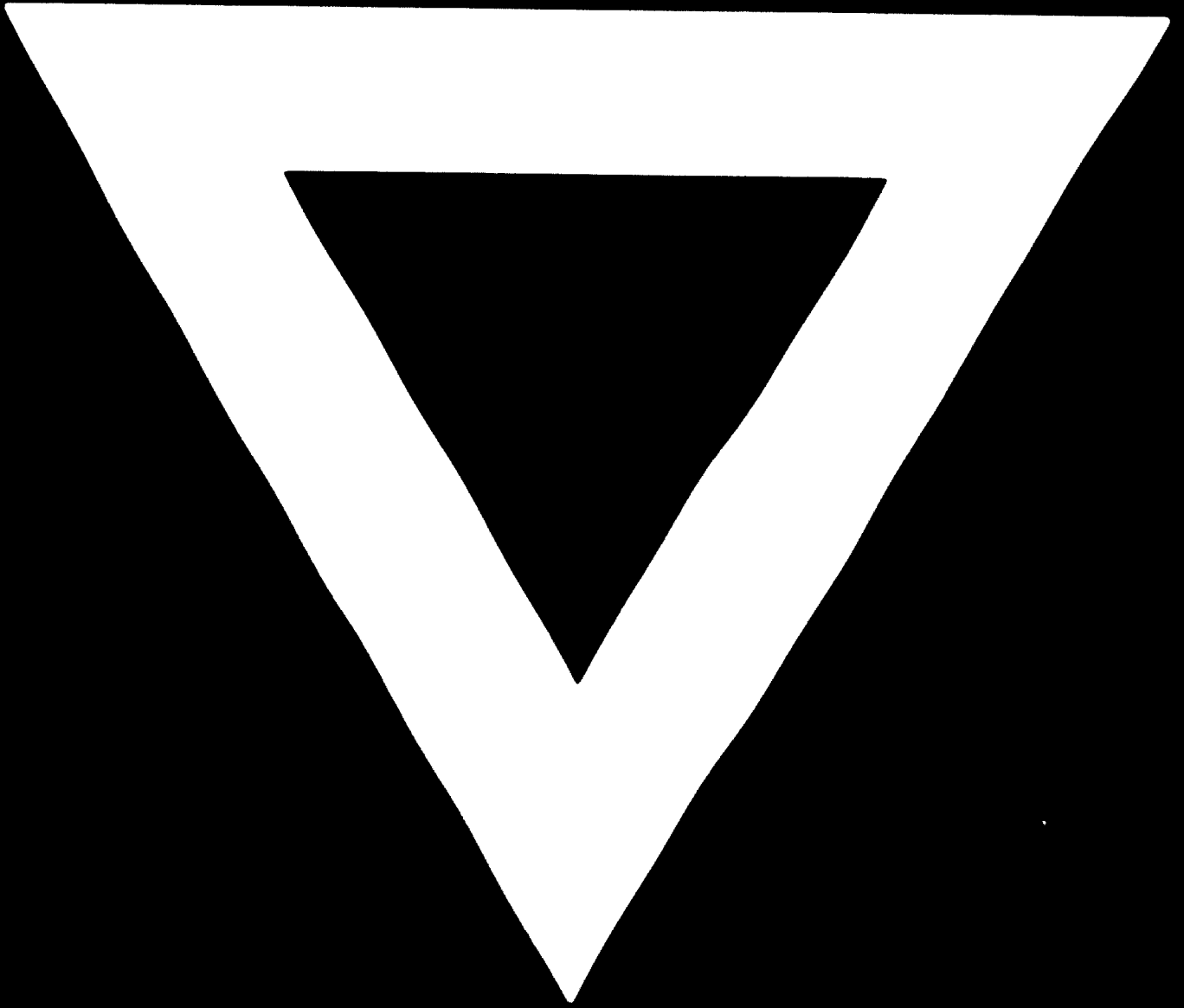
**Mr. S.G. Murtaza Shah, Joint Secretary, Ministry of Science and
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Dr. M.A. Khan, Chairman PCSIR

**Dr. M. Saifur, Deputy Scientific Advisor, Ministry of Science and
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