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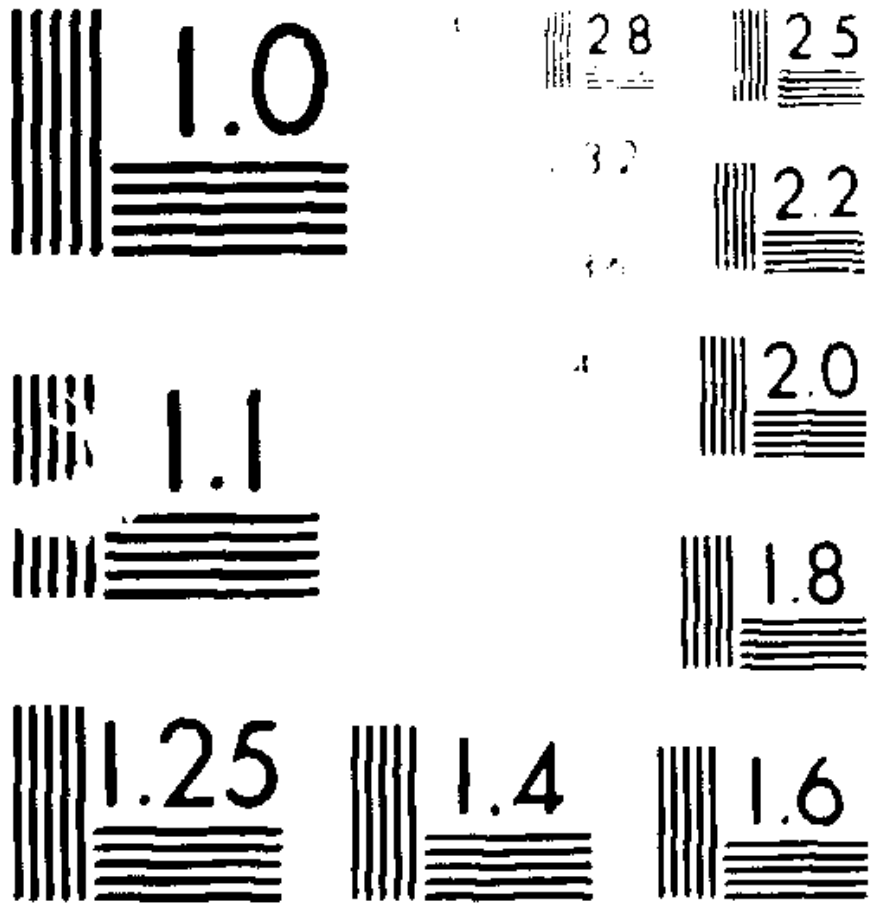
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Distr.
LIMITED

UNIDO/EX.124
24 July 1980

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

ENGLISH

UNDP/UNIDO STAFF WORKSHOP

on

INDUSTRIAL RESEARCH AND SERVICE INSTITUTES

2 - 4 June 1980, Vienna

Raising the Performance of IRSIs through Improved Planning and Administration*

(A summary of Theme II discussions)

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I. Explanation of theme* - Richard E. Westergaard, Chief Engineer, Central Institute for Industrial Research, Oslo, Norway and IRSI Consultant.

There are many shortcomings and problems with IRSIs and the purpose of this evaluation exercise is to try to remedy this situation and, in the process, identify some of the critical conditions that have to be met for successful performance. One, of course, is that there has to be a need for the services to be given. If the IRSI does not have any industrial target, it has no purpose. It can serve existing industry but seldom create it. If an IRSI is set-up to solve certain problems, for instance related to natural resources, it must be ascertained that the goals which are set out are realistic. Very often people dream that they can solve insoluble problems. The resources needed, i.e., manpower, foreign exchange, etc., are very often lacking. An IRSI must also fit the existing situation and industrial infrastructure in a country and what is good in one country may be not good in another.

Very few people actually know much about the role that an IRSI can or cannot perform in the process of industrial development. The politicians in the developing countries certainly do not know much about it. Even in the UN it is difficult to compile and use this type of information because of staff turnover and disciplinary provincialism. Very often we underestimate the time and cost it takes to build an IRSI and overestimate the capacity and capability of an IRSI to solve problems of industrial development. Some think that ten men can do the job of thousands, actually an extension service, and we have found that the planning, including the identification of clients and their needs, is often inadequate.

The task that I have been working on recently for UNIDO is trying to develop a planning tool which can assure that we don't repeat all these mistakes. It is very important to have a tool which can pinpoint to the government and everybody concerned all the conditions that have to be met in order to succeed. If we find out in advance that these conditions cannot be met, we should not start the project or we should change it. We should always make a feasibility study before a large-scale project. Few people know how to do this. Staff or consultants visit a country and ask industry or government, "Do you need research?", and they don't know what research can do. It is not fair to ask questions like that. We need a handbook of procedures which can reveal the problems and which can assure that we don't overlook important factors. We have, therefore, tried to develop a systematic planning tool as a technique which can be used. I also have proposed that we provide "how-to-do-it" manuals covering the more important subjects like how to administer a research institute, how to build up a chemical lab, what you can do in terms of feasibility studies, transfer of technology, etc. It would be a detailed book on each subject and it is important to compile this in such a way that it is available and can be used by the people who come in fresh to the subject. Although instances vary a good deal, we can define certain activity modules, as we have chosen to call it, which reoccur very often like information services, chemical laboratories, materials testing,

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* Extracts are provided here. See formal paper prepared by consultant for more detailed exposition (UNIDO/EX.114, dated 21 May 1980). This session was chaired by M. Aref, Deputy Director, Industrial Operations Division, UNIDO.

extension services, feasibility studies, etc. There are also certain branch-oriented laboratories for textiles, leather, etc., which occur often and for which we could usefully prepare manuals. These manuals could be produced without too much effort by taking advantage of the people who work in the field, information which has already been compiled, and also by the literature which already exists, e.g., a good book on feasibility studies.

In Pakistan, they had a lot of research institutes, some of them quite large, very well-equipped, and their experience describes a very typical picture. They started out being too academic, at least the government thought so, and they were told to be more applied. Then IRSIs started to invent processes and products mainly based on natural resources. They encouraged people to buy these processes and put them into use but very few people were interested because they could make money in a more efficient and safer way by importing or producing normal things and they did not believe that the IRSIs could produce a plant, a process or a product that could work and sell. They were right, most of these projects were uneconomical, unrealistic, and unfinished. Next, the government decided that the IRSIs needed pilot plants to demonstrate what they could do. That cost a lot of money and the researchers became more like pipefitters after a while and still it didn't sell. I think the final solution was that they gave up much of the multi-discipline and multi-branch institute approach and switched over to single-branch institutes working in close cooperation with the client-industry.

There is one constraint which is very pervasive, not only in developing countries but also in a country like my own, that is, the low government salary scale. It is almost an insolvable problem because you cannot claim that research is more important than government itself. If you argue that researchers need higher salaries than the ministers themselves they certainly will say no and if you give researchers special privileges, the others will say we're just as important. The point is if you want to have people who form a "center of excellence", they also have to have excellent salaries and if they can't have that you can't have the people, it's as simple as that. If it is impossible to do this by giving autonomy to the IRSI or if the scale doesn't compare with industry, you just have to give up. You cannot do advanced research, or sophisticated consulting with industry without being excellent so we just have to face this. Also it would be wrong in a continent like Africa, where they have very few trained people, to attract good people from the government or industry into research institutes. They would probably be more useful where they are.

I once visited an institute in the Middle East which had beautiful buildings and equipment. It was planned with assistance from both UNESCO and UNIDO, and the experts probably made many of the mistakes we pinpointed in the evaluation but that was not the main reason for its total failure. They had equipment and to some extent the necessary skills but the Center was wrong, politically and economically. This country has a centrally-planned economy with a large public and a small private sector. The private sector did not want to use the government's institution because they did not think they were skilled enough, nor did they want them to become

skilled, so they stayed away from the IRSI. The government people considered this an external body that was sent to watch them and they didn't want to expose themselves. They made many mistakes and wanted to keep it to themselves so the institute was left in a total vacuum. We often preach the gospel that these institutions need autonomy. In this country I think maybe what they needed was to be part of the government. They did not need autonomy because they could not use it. They did not really have it but they were separated from the routine bureaucracy. If they had been a part of the government, inside the bureaucracy, with their skills it might have worked. This is an example of how extremely important it is to analyze the economic and political climate in each particular country.

Another example is that the goals (policy objectives) set-out for industrial research institutes are often entirely unrealistic. We have people who think that they can substitute for foreign technology by doing their own research and this, of course, is nonsense. For example, a country may want a steel mill and a steel industry because they have some iron ore but everybody has been telling them that this ore is no good. They set up a research institute to upgrade the ore so they can eventually have the steel mill. Most of the time they never get a steel mill that way and if they do get it, they probably get it five or ten years too late and the steel they produce may be so inferior that they will affect the other industries with results which are totally negative. In agriculture and other industries that is a lot of waste produced as a by-product and people think they can use these wastes, for instance, gypsum from the fertilizer industry to make building blocks, etc. These problems have been worked on in many countries with marginal benefits for most developing countries. To start research on things like that is a waste itself. Similarly, with agriculture waste, there is a logistic problem of collecting and keeping it from rotting. To do research on small samples that you get fresh and develop processes is most of the time a total waste. So they need advice and of course it is difficult to take advice.

Before Christmas, we worked for two weeks, and prepared a first draft of a new method for the planning and evaluation of IRSIs. It is a planning method where you go step by step, beginning with a feasibility study where one checks all the conditions that have to be met for the institute to work, and it proposes various manuals on special subjects, etc. If this were being used a lot of problems, some of them critical, that are often overlooked would be foreseen. The question is whether this should be further developed and put into use. I believe it is very important to produce something tangible, something that will be routinely used by UNIDO experts but it could meet with a good deal of resistance. One reason is that many IRSI project proposals are unsound and some people may not want to know that, either on the government or UNIDO side. If you tell them the project plan is no good it takes a lot of guts to turn around and replan. For developing countries it is a shock if you tell them that they will most likely have to support these institutes for at least twenty years and they start counting the long-range cost while in the project document you have projected only for two or three years and it sums up to be 1 1/2 million dollars while in

a fact you commit them to 10 times that amount or more. If you tell them what they have to really face they may give up. Politicians have to use tricks like this to get things started. Too much straight talk may ruin the whole game. These are difficulties we have to face and I foresee that in some country the resistance could be too great and this system could not be used, at least not effectively. It would be easier to introduce it into the UNDP than anywhere else because they hand out the money and don't want the projects to the same extent that all the others do. So it could perhaps be enforced by the UNDP, they tell UNIDO that unless you have applied this method of analysis we won't approve the project. You could tell the same to the developing countries and some of them might be willing to listen and use it. Some will say this is not your business. We want an IRSI and have decided to use our IPF for that and we don't want all these silly questions. OK, we have to live with things like that but I still think that it could be applied and it is worthwhile to develop.

II. Panel Discussion*

The chairman initiated the discussion by pointing out that one may have the best plan in the world, there could be a definite need for IRSI services, and it could also be ascertained that there would be a fair chance of finding solutions which are technically and economically feasible but you will may not have the people to do the job. Unfortunately, or fortunately for research people, well-qualified scientists have broken the "visa barrier". He is not sitting in the developing country suffering a meager salary or abuse by the boss or politicians, he applies for a good job in the United States or Canada. Approximately 50% of the research people in Canada are first generation expatriates and about 30% in the USA. The brain-drain problem is very serious as far as research is concerned and this is not a new phenomena. Throughout history, people went where the opportunities were. The basic problem in establishing an IRSI in a developing country is to convince the government that if they truly need an IRSI, they need to change the system under which their research scientists are handled and if they are not giving scientists enough compensation to convince them to stay in their country of origin then we should tell them it is not possible to operate an IRSI.

Agreeing with many of the points made by the consultant, a UNDP field representative pointed out that in many cases preparations were not sufficient, resulting in ineffective Pro Docs. A feasibility study should be carried out with, perhaps, assistance from an advisory mission, but from past experience we find that agencies sometimes issue a speciman copy of a pro doc which they give the government and say, "Here is a project. Would you like to have a similar one?" In many cases it was found that the pro docs were almost identical, or very similar, and this no doubt contributes to the shortcomings one discovers at later stages. The caliber of the experts is also critical, not necessarily from highly advanced countries but experts who would know the local conditions, who

* Those portions of the panel discussions most relevant to the theme are summarized herein. Panel participants included: A.S. Bashin, Deputy Resident Representative a.i., Libya; F.M.Iqbal, SIDFA, Indonesia; B.R. Nijhawan, IOD; F. Soede, IOD/INFR; K. Venkataraman, ICIS/TEC; and G. Verkerk, IOD/CHEM.

would be able to convey or transfer the technology in a manner that the local counterparts can benefit. In some projects we find that the components are not balanced, e.g., you find that a heavy component for equipment, very sophisticated equipment called for in research, when it is apparent that nationals of these countries cannot operate or maintain such sophisticated equipment without long-term training or assistance. It is essential that at the preparatory stage, one should take this fact into account. Project documents refer to evaluation but it is not always a very satisfactory exercise. In many cases, no tripartite reviews were held, no mid-term evaluation was carried out and, at the end of the project, one is taken by surprise that there are deficiencies and shortcomings. If the project had been evaluated in its earlier stages, then one would have discovered these shortcomings and taken remedial actions. In some projects, the technical backstopping from the agencies leaves much to be desired. Experts seeking technical advice often don't get advice from headquarters. Frequent backstopping visits would be useful so that any shortcomings can be detected. Finally, the training of national counterparts is an important aspect of a project. Experts don't give as much attention as they ought to to the training of their counterparts. They concentrate on day-to-day events, solving technical problems, installing equipment and making repairs, and leaving little time for the training of the national counterpart. This contributes to the frequent requests for extensions of projects.

The next speaker, from the TEC group, noting the very large number of IRSIs that have been established either with UNIDO or UNDP assistance or otherwise, suggested there are a lot of investments which have to be made good. The defects in the IRSIs are generally quite well known, they have now been documented. The question is how do we turn these defects or negative points into positive guidance? A checklist, of course, is important and should be built into the project design. Traditionally we have been concerned with the monetary inputs, i.e., equipment, training, fellowships, experts, but there are a number of aspects which are not very money-intensive but which can contribute a great deal to the improvement of an IRSI's performance such as the interlinkages an IRSI should have with industry, etc. So the checklist idea, though good, has certain limitations which should be understood. It is not the enumeration of a very detailed checklist that is important, but the concentration on the impact areas, those areas which are most critical to the success of the institute. First we have to identify the starting point which is often wrongly placed as, for example, saying that you should strengthen the staff, strengthen the management, improve internal routines, etc. The starting point should be the priorities for research. Unless or until you establish the system of industrial and research priorities you will not be able to say how much or the type of a staff you need, what is the kind of management you need, the order of finance required, etc. Another deficiency critical to effectiveness is the poor record of R+D commercialization and inadequate industrial extention services. If performance is judged in terms of the final results and their impact on the economy, then commercialization is undoubtedly a very important thing. If we have to draw up manuals, give extra training or initiate further actions, the speaker suggested that commercialization and industrial extension services may be the most critical areas. Only after laying down the starting point, namely the priorities and expected

results, i.e. commercialization, etc., can we really come to staff, management, etc. This will derive from the major policy stress. The other is indigenous technology. He suggests that surveys have to be made of the technologies in each area, otherwise the priorities cannot be really developed. Many of the problems enumerated, particularly the existing ones, are not those which need large investment of money or long periods of expert service. Many of them may be of a diagnostic or trouble-shooting type or to advise on particular problems which the research institutes are concerned with at the moment. They may be a case for an international referal network and technological advisory services to which IRSIs can refer a specific problem for advice, resolution or information and which has the facility for contacting the experts in the field and coming up with some suggestions.

The next speaker, a UNIDO staff member with long-time experience with single branch (iron and steel) IRSIs, lamented that many people providing advice have never worked in a laboratory or research institute. Such advice is quite often completely devoid of any background or experience but given by those planners and administrators who control the political or the organisational structure of the particular organisation or Ministry concerned, and they have to be listened to with great respect. In his opinion, there are no universal yardsticks or parameters which every country can follow, that each laboratory can follow, that each research institute can introduce either for developing or developed countries. Each country has to pass through their own experience and establish the best parameters applicable to their own set of conditions. The first function for the research institute is to concentrate on applied R+D work, including investigations directly related to industrial problems. They will need to establish a body representing the industry, both in the public and the private sectors, to identify the problems which the institute should undertake. The scientific staff must be involved in the day-to-day operations of the research project itself and be provided with incentives. He gave an example of a system of incentives in one IRSI. When a process was established, and it proved to be successful on an industrial scale, it was released to the industry and 40% of the income thus gained from the industrial application was distributed to the scientific staff while 60% went to the government or the body which financed the institute. In this way, staff involvement was very substantial, and they got excellent results, and the laboratory and the research institute gained a very good income. A lot has been said about sector priorities and problems, but a continuing liaison with industry is at least equally important. One has to win industry's confidence, to make them feel that the IRSI is at their disposal. Once they are convinced, the IRSI will get more support from the private sectors than from the government. Once you win the public sector, your support is complete. This is a process which has to be followed very painstakingly and one should not despair. The speaker is not disheartened by the many difficulties and mistakes made by the research institutes. All IRSIs must each pass through this cycle and learn from these mistakes. Developed country institutes were not born successful, they have learned by their own mistakes. These mistakes must be made and one should not say well they are uneconomic. Uneconomic or inefficient compared with what? This speaker concluded with a plea that

one should learn from experience, and plan the actual problems of the industry from the shop floor. Then put short-term and long-range projects into motion with groups of scientific workers who had, in parallel, been trained at home and abroad, and bring forward the linkage to the research and development institute itself. It's a question of applying confidence in an institute which UNIDO has sponsored with UNDP assistance, and by and large the process of learning from mistakes.

A member of the Institutional Infrastructure Section, which is concerned with multi-branch research institutes, and who also participated in the joint study, described the first actual application of the recommendations and suggestions made in the study, which took place in Tanzania. The government requested UNIDO assistance in the creation of a multi-branch IRSI. One of the first steps was to bring the designated Director-General to Vienna while the evaluation study was still in its process, and he had the opportunity to benefit immediately from all the preliminary findings and ideas which were being generated and discussed at that time. UNIDO did not have the opportunity to influence the decision of the Tanzanian government regarding the role and coverage of the IRSI. The law establishing it had already been passed by Parliament so UNIDO hadto accept a multi-branch, multi-functional institute as given. UNIDO also had to accept the priorities of the government which were spelled out in policy statements of the minister. Nevertheless, UNIDO could and did carry out a preparatory mission in which two consultants and the backstopping officer carefully surveyed both the requirements of industry (they surveyed about 10% of the existing industries) and took a very thorough look at all the existing industrial institutions. The speaker recalled a dinner with the Minister of Industry at the conclusion of their work where he told him that the creation of the institute would take 20-25 years until it would be fully operational. The minister was absolutely shocked and he said, "This is impossible!" It was difficult to convince the minister that 20 years would be the minimum to do serious R+D in Tanzania but he finally accepted the message. The major problem in Tanzania is not the money, or lack of outside offers of assistance, rather the huge problem is the shortage of human resources. At the moment they have a Director General, a deputy, and some Tanzanians working in industry, and that's it. They will need to develop an institute employing perhaps 200 people so this is the challenge, i.e., to get the human resources lined up, get them trained first in other institutes, and then hope that they will stay in Tanzania and gradually participate in this huge endeavour.

The SIDFA from Indonesia described current efforts to establish effective linkages between the several IRSIs and their clients. Essentially, they took a cue from the government priority given to small-scale industry development and developed a demonstrative model. Fortunately, they had a number of technical assistance projects assisting the government in the establishment of extension service centers and previous generation projects which called for the strengthening of several IRSIs. They turned it around and changed it into a more programme-oriented assistance directly tied into extension services for small-scale industry.

The importance of the government's contribution to the growth, performance and success of an IRSI was stressed by another UNIDO staff member. Without such support, the best designed and managed project will go awry. In addition, the public and private sectors in the developing countries must, through their government, take an active part in the implementation of an IRSI project, as no project will be successfully completed without it. UNIDO should prepare its projects well but even with this, the project will be evolving and never will stand still. It most probably should be revised after one or two years, after a comprehensive review of government and industry needs and other outside events which affect the project design.

III. Open Discussion*

The UNDP study co-ordinator explained that during the field missions in which he participated the governmental financial sponsors pleaded for the international system to tell them how to increase the effectiveness of their IRSIs. Some in this workshop have indicated that IRSIs should be restricted to testing and analysis in its initial endeavours, to simple or basic services to industry, etc., which may give the impression that the UN is shying away from the R+D function. This point of view is recognized as practical, but politically the question must arise because every country wants to do R+D. If R+D is to be undertaken, people of talent including the supporting technicians, are necessary. Who are the people that we are trying to get involved in IRSIs and do we have them? The world historically has had migrations of talent. Why is this the case with R+D? Really, it is the conditions of work. Talent migrates to a place where it has the adequate conditions of work, and this does not necessarily mean salaries, because the conditions of work is the sum total of things that make it amenable for an individual of talent to say I want to go and work there. This migration of talent takes place because the individual wants peer recognition, i.e., among his own professionals. While such recognition can be obtained by publications, true recognition for the individual is in the utilisation of his work in a practical manner, i.e., talent migrates to those places where it will be used. To a large extent, what we're trying to do in this business is bring the talent back to developing countries. The persons who have the talent for R+D must have an inclination to study the unknown and that inclination to explore the limits of knowledge is most often found in the young. But as the young get older, they often find out that R+D is not really what they want to do and they change. Yet R+D must have the leadership of senior R+D people. These are people who decide that they like this type of work and they are the mentors of these youngsters who are doing their "thing". But those youngsters also must have the leadership of the production-oriented senior people. As the chairman mentioned, they are not only the professionally trained scientists, but they are also the engineers and technicians. They are the labourers and the operators in industry. It's a mutual recognition among individuals that they are con-

* This is a highly-selected and truncated summary of the extensive discussion which took place between panel members and other staff members in attendance.

tributing to a common purpose. A recent phenonomen is the rising nationalisation of research and development. Until now, research and development has had no boundaries. It has always been international in character, because the scientists and the technologists do not recognize a country. They march to a different piper. But governments want to nationalize R+D as a means of lessening their dependence on others. The function of R+D needs to be addressed, then, from three points of view. First is the political consideration for R+D, and that is what we hear mostly from the governments we serve. Second is the economic consideration of whether it is worthwhile to do R+D vis-a-vis other alternatives. The third consideration is the scientific and technical talent necessary for R+D. Since the majority of the workshop participants are scientific and technical people, the solution of how to improve IRSIs and make them of practical use to society must eminate from here and similar sources.

The UNIDO study co-ordinator pointed out that the IRSI joint evaluation was not the effort of a single individual, but of a large group including professional staff of both UNIDO and UNDP who are, to a large extent, engineers and researchers themselves, plus the best consultants obtainable, consultants like Dr. Westergaard who have been at the bench level with shirt-sleeves rolled up working with IRSIs. Calling himself a professional bureaucrat, he opined that the only difference between himself and most of the people attending the workshop is that he trained to be a bureaucrat. He described all staff members as professional bureaucrats, albeit some with a technical or R+D background, because very few do any appreciable technical work per se. They help plan and implement, monitor and evaluate, and provide advice for other people on how to do things. The evaluation exercise has clearly indicated that the single most important thing UNIDO and UNDP can contribute to the process of launching "successful" IRSIs is in urging better planning, and providing advisory assistance, for institutional growth. Planning does not mean developing a blueprint for every person or unit, what they are going to do, schedules, and similar operational detail for five or ten years in the future, which is a futile exercise under any circumstances. But in conditions of scarce resources, mostly human resources, although many countries starting or maintaining IRSIs also have scarce money resources, and where you have a great deal of undertainty about the future, and any institution-building project in developing countries involving technology is full of undertainty, it is there where the planning process is most important. And it has to be a continuous process because the environment is constantly changing and one must perceive what the effects of such changes will be on the institution with some retraceable logic. If an IRSI is not going through a process like that, it is simply being bounced back and forth like a ping pong ball, and probably is going to score few points in the game. What often happens in the U.N. system with these type of projects? The documentation indicates that it usually begins with the country allocating a part of its IPF for an IRSI. In more cases than not, the government sponsor doesn't know what it wants or how to get it. Someone has an intellectual perception that if they have an IRSI, whether it be multi or single-branch, something good is going to happen. (This problem seems to be more prevelant in multi-branch rather than in single-branch institute because, almost by definition, if it's a leather, iron and steel, or a textile institute, it's closer to the industry it's going to serve and knows its problems and needs). The country may think that

by establishing an IRSI it will establish new industry or can accomplish goals completely beyond the scope of any IRSI to do. Then UNDP comes into the picture. Quite often, the Res Rep's main concern is to get the Prodoc signed and get on with the implementation, which should be completed in two to three years. UNIDO comes on the scene and their prime motivation seems to be to get the project before UNESCO or ILO come into the picture. If, as also came out of the textile study, it is important to have preparatory assistance for adequate problem analysis and project design, then why is there so much resistence? Why does the recipient country and the Resident Representative so often say to UNIDO, if they dare to raise such questions, that we know what we want, we don't have time or the money to waste on planning, or we'll work it out during implementation? Why does UNIDO often acquiesce without a murmur? The first, the most important step in getting one of these institutes started, in the speaker's opinion, is not selecting the site, it is not designing the building, it is not ordering the equipment for the laboratory or arranging out-of-country fellowships. It's making some kind of assessment as to what the current and projected industry needs are in terms of services. This has to be a cursory assessment in the beginning, a critical planning assumption, to help establish the policy objectives which the institute is going to pursue and its range of functional activities. Is the institute's main role going to be developing new technology, new industry or strengthening existing industries? Is it to improve the quality control of an indigenous product for the export trade? Once those decisions have been made, it sets the framework for staff development and required skill composition which is the most critical factor in the maturation of an IRSI. Two of the three players in the game are present here today, the donor agent and the executing agency, and the speaker pleaded for recognition that preparatory assistance, with the emphasis on planning for institutional growth and client service, is the sina qua non of a successful institute that will avoid unnecessary mistakes, become viable and survive.

The representative of the IFSTD, a former SIDFA himself, suggested that a resumé of the workshop discussions that have taken place up to this point would indicate that, in spite of the efforts of the UN system, in spite of the large numbers of workshops, publications, and other conventional devices that have been used, the management of research institutions in developing countries still leaves very much to be desired. He questioned whether this is not a point to think in terms of some different and innovative approaches. For example, in the People's Republic of China most innovation takes place on the shop floor. The so-called "three-in-one" team, i.e., a worker who really knows the machines, a political worker or a manager, and a scientist, solve problems at the machine, product, field and energy-use levels. This is one of the alternatives to IRSIs which should be investigated, i.e., how we can stimulate this kind of innovation in developing countries. Everyone is familiar with difficulties on the national side, viz, to provide the kinds of counterparts and inputs that are called for in the project document, the whole business of trying to get more significant responsibilities placed on the government in the implementation of projects. Government execution of projects is a highly controversial subject, but a system where the government feels far more responsible for the execution of projects is absolutely necessary. In a recent meeting, for instance, of the Inter-Governmental Committee on Science and Technology, a very strong anti-UN agency feeling was expressed, a

belief that the UN agencies have not delivered. There is a feeling that the UN is thrusting projects on countries which are not yet ready for them, and if the UN is to get away from this it has to be more amenable to alternative ways of executing projects. The speaker's third point related to motivation, recognizing that the success or failure of a research institution ultimately depends on the people who man it. Insufficient attention is being paid to financial incentives. Peer recognition and conditions of employment are important, but money is a very strong motivator in the final analysis. This is an area where UNIDO could usefully survey incentive systems used in the research sector in other countries which could be adapted to specific situations in developing countries. Finally, there is this whole business of TCDC in developing research institutions. In Turkey, TUBITAK established a strong linkage with CSIR in India and some of the most satisfying and cost-effective consultancies took place where experts from India, for example, came to the MARMARA Institute and transferred technology in very sophisticated and highly-secretive fields. TOKTEN, the transfer of know-how through ex-patriate nationals, originated in Turkey where, in the last three years, 160 highly-trained former nationals were bought back for short-term consultancies, almost a third of them from research institutions in the United States. This type of consultancy lends itself very well to research and development and management. These people spoke the same language, knew the bureaucracy, had access to high level people, and were able to accomplish in four weeks what an outsider, a complete international consultant, might have taken eight weeks or more to accomplish. Even more important, when they finished their job in Turkey and went back to their countries of adoption, the linkage did not stop there. They continued to feedback technical literature, computer software, satelite maps, books and other materials which the Government of Turkey would otherwise not have the access to, and this became a continuous feedback of information of a very effective kind.

The question of incentives and pay evoked a response from the chairman who commented that research is not one of the sectors strongly supported by many governments. Even in industrialized countries, when they have to reduce budgets the first thing cut is foreign aid and the second is research. This is something research people have to live with all over the world, and to ask the developing countries to have high salaries and other special incentives for the researchers is a bit difficult. Governments want to see what they are paying for and research takes time before it can show its results.

Another UNIDO staff member told of his experience on a terminal evaluation mission of a multi-branch IRSI he had back-stopped and stressed that such institutes often have an identity crisis. Very often industry is not even familiar with the departments which are the equivalent of single-branch institutes. During the evaluation exercise, they used a unique method, i.e., they made a telephone survey of industry asking such questions as: did they ever hear of the institute; what do they think of the institute; did they have anything to do with the institute; does it give good services; etc. One of the conclusions reached was that there is an inverse relation between the size of the particular enterprise and whether it uses or knows about the services of the institute. In other words, the smaller the industry the less involved it gets. They

didn't even know it was there, or what it does. The larger an enterprise, the more likely it was to use the institute. They know what they are doing, know what questions to ask, know how to use the institute's capabilities. In this particular IRSI the staff was adequate, they had some good equipment, and were capable of doing good technical work, but they were not being utilised. The evaluators tried to find out the reason for this. One was internal, viz., the institute's own management. There was a single advisory body which handled the institute as a whole, instead of each individual department having its own specialized technical advisory group who would sit down with them every three months representing, say, the wood industry discussing what the IRSI is supposed to do for that industrial client. This had not been taking place and they were left hanging in limbo. The relative success of each of those departments depended very much on the individual who was the head of the department. If he was a dynamic man, who was active, who went out and contacted industry, his particular department did good work. The department which was introspective had a head who liked to do his own pet work and had practically no industry contacts. The director of the institute started it off with good contacts in government and had a clear objective of getting the institute started but once it was going, he was very weak in administration. He did not want to delegate any authority and became an impediment. Such a condition might have been alleviated significantly if smaller advisory groups were supervising the technical work of each of these departments and keeping the momentum going. Such a scheme must be put forward during the project formulation or preparatory stage because once the system is established the director tries to hold on to his powers and you cannot easily change it afterwards. There is a sentence in the original report on the evaluation exercise which states that the success of an IRSI, be it single or a multi-branch, depends very much on who the top man is. This is no different in the industrialized countries. The personality and leadership is so crucial that we can plan till doomsday, we can get the best tools, etc., but the institute will lock itself in. The speaker concluded that it is imperative to tell the government that the IRSI just won't work without the right man. He also warned on generalizing too much on the Chinese experience as an innovative method of helping industry. While the shop approach is efficient at the micro level, there is a danger that they keep repeating the same work in every plant, particularly if the results are not disseminated. It may not always be the best use of scarce human resources.

A subject of very great importance to the efficiency of IRSIs is the repair and maintenance of equipment. According to one participant's experience, 50% of the equipment in IRSIs is out of operation for some reason or other. In one project, a maintenance and repair man was provided for six months who systematically went through all the instruments and repaired and cleared them up. He suggested taking a regional approach, i.e., selecting a center somewhere in one of the regions and establishing a "flying squad" of repair engineers, available to all the countries for maintenance and repair of equipment. Also, a revolving fund of foreign currency could be established to help institutes quickly solve their spare parts problems. It is possible that both of these regional proposals could be financed by the IFSTD. Country projects should also include a training programme for one or two electronic technicians who can take care of equipment and instrument maintenance.

One participant questioned using the yardsticks developed in the industrialized countries for measuring the performance or expectations of industrial research institutes in developing countries. The rate of return on the investment is irrelevant because it must be perceived as long-term. In the same manner as with the feasibility studies of industrial projects, the socio-economic benefits of the IRSI must also be considered. The speaker, along with several others, endorsed the point about the choice of the national director and stated several cases where this had been the principle problem. The same may also be said about the project manager. Noting that a publication on administration and management of industrial research institutes already exists, the speaker did not believe more guidelines and manuals for preparing or planning industrial research institutes are needed. He pleaded for freedom, i.e., if there is enough justification for the project and it is well planned, that is enough. UNIDO and UNDP have to rely on the initiative of the people who plan or write such project documents. At the same time, one must involve both the private and public sector industries during the planning stage and get their views and support.

The head of a section concerned with single-branch institutes pointed out that the evaluation study had two serious self-imposed limitations. The first concerns the definition of an IRSI - "For the purpose of this study, an IRSI is defined as a multi-purpose technological institute which provides services either to a group of industrial sectors (multi-branch) or a single sector (mono-branch), and which has a major research and development component". In his view, there are not many developing countries which would be prepared and able to establish and successfully run a multi-branch institute of this profile. The study fails to make an adequate distinction between multi-branch, multi-purpose and single-branch, single-purpose institutes. The rules, conditions, background, and requirements are completely different and the study treatment results in generalities and a mixed-up picture that may be applicable in one case but not in another. A multi-purpose, multi-branch institute is much more difficult to establish and run than a single-branch institute where, in developing countries one is dealing with, for example, an emerging or existing metallurgical industry of a dozen plants. In a case like this, a single-branch type of institute will find at least two of the three basic components which are required for success. One is an industrial background, an industry, either operating or under investment. Without an industry operating or coming up one cannot start a single-branch institute. The second is the subsidizing local partner. An institute without subsidizing makes no sense. This is not an investment venture in general. Either the government or the industry itself should do this, and preferably the latter, because if the industry is interested from the beginning, if the budget of the institute is included in the budget of the industry, there will be no difficult problems of clientele, selling the product or services, or finding what it is it should do. The third basic component is the staff. An institute should invest the majority of its inputs into support and extension activities. This automatically justifies the establishment and activities of an institute. The second serious self-imposed limitation, the speaker suggested, is the inwardly-oriented analysis of the activities and problems of IRSIs. It is impossible to make a successful evaluation

of the conditions, results and necessary actions to be done for improving the work of an institute without analyzing the existing economic and social background and other relevant circumstances. This part of the analysis and considerations was missing from the study report.* Concerning assistance, the best way UNIDO can help the institutes is in establishing the necessary framework and conditions in which they will work. UNIDO should avoid assisting institutes where the basic conditions do not exist. The UN cannot undertake the responsibility if these basic conditions are missing.

As one of several speakers responding to the above viewpoint, the consultant explained that in a marginal IRSI previously discussed, he didn't believe the reason was that the project manager, or the director, or the planning was particularly bad. The main reason for failure was the economic-political context in which the project was placed. As a candidate once for this project manager job, he was not at all sure he could have done any better than the man who was there, unless he could have persuaded the government to change entirely the set-up and make the IRSI a part of the government or a part of private industry and re-do the whole thing once we found out that it couldn't work in the existing context. Regarding the existing publication on administration of industrial research institutes which was previously mentioned, he agreed it was a good book and was a great help to him in his first job as a project manager. But it's not a manual, it's more guidelines and philosophy. He was faced with the difficult job of designing contracts for clients, designing salary systems, forms, hiring systems, accounting systems, billing systems, etc. Fortunately, he had with him copies from his home institute and had been living with these problems for many years, so he knew approximately what was needed. But in the country in question, for instance, they had this book too, but no administration whatsoever. This was partly due to lack of planning and there was no requirement that an administration be established and account for its progress, contracting, expenditures, etc. It's a lot of work and unless one has a good example to work from, manuals would be indispensable. Not books, but these too have to be updated from time to time, but recipe or cook books that can be used to solve all the simple questions of daily operations like a housewife who is going to run a house. If she has a cookbook she can look up how to do things and even if she doesn't know anything about cooking she can still manage. Many project managers and institute directors don't know how to cook. The consultant reiterated his proposal on the need for good manuals with a lot of detail, and if one has to deviate from it, it will be because one consciously determines that it has to be done differently, not because one simply forgot or was unaware of how it could be done efficiently.

The UNIDO evaluation officer made two points of information about some previous remarks. On the question of self-imposed constraints, they were there, but why? First, one has to limit the scope of an exercise to make any useful generalizations. If the exercise had been concerned with industrial service institutions as a whole, we'd still be working on Phase I. Second, some UNIDO professionals in operations had advanced the

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* Note - The individual country IRSI evaluations were included in the back-up material which received limited distribution but not in the staff report itself.

proposition that multi-branch, multi-functional, vis-a-vis single-branch and/or single-purpose, institutions were the most cost-effective method for helping developing countries, particularly the least developed, and there was considerable controversy within both UNIDO and UNDP as to whether this assumption was valid. He believes that the evaluation study gives a clear answer to this question. Third, UNDP, as a co-participant and co-sponsor, noted that an awful lot of IPF money had gone into these peculiar type of multi-functional institutions in which R+D was, or was supposed to be, a major component, and concern had been expressed about their developmental impact. Finally, at least as far as performance is concerned, there was a premise that useful lessons could be learned from both types of IRSIs, i.e., multi and single-branch. Regarding the inference that outside consultants were used in preference to in-house professional staff, every conceivable effort was made to get effective IOD involvement in the exercise and we did get some participation. Unfortunately, the pressure of daily operations kept IOD from participating as fully as perhaps it would have liked to, particularly sections other than Infrastructure. There were four teams who went to eight countries for two weeks each. Each team had (1) a UNIDO staff member on it who knew something about IRSIs and two of them had research or engineering in their background, (2) a UNDP officer with similar qualifications, and (3) a consultant. Each consultant was selected because of his personal and detailed knowledge and experience with IRSIs in developing countries and all had research backgrounds. After the field missions, all participants met in a retreat in Spiez, Switzerland, through the courtesy of the Government of Switzerland which contributed to the exercise, where more people from UNIDO's professional staff were brought into the picture, including Mr. Gouri's group, to arrive at the final synthesis. The exercise was probably the optimum that can be expected in the UN system. It is a legitimate question, however, whether these type of evaluations just draw too much on our resources versus other evaluation alternatives, e.g., an internal evaluation system focussing on on-going field projects.

A speaker from the Training Branch agreed with previous participants who stressed the importance of training technicians as well as PhDs. He suggested that each IRSI of a reasonable size should have at least a training unit to orient and train educated technicians or update them for particular jobs in the institute. These institutes should also have programmes, maybe carried out by the same unit, to train the potential users of their services and R+D products. It is well known that industry is sometimes most reluctant to accept or adopt the results of research done elsewhere, because it normally means innovation and risk and such training would inform them on how to make best use of the results of the research for the benefit of their enterprises. A third training target concerns the higher echelon in the institute who don't need fellowships but, particularly if they are newly appointed, may need a study tour to meet directors of other institutions and to see what their solutions for problems are, to establish a network of correspondence and this type of linkage. In the next programming cycle, countries might find it useful to have a "blanket" project included in the country programme, not only for IRSIs, which gives countries a flexible tool to provide such type of short-time ad hoc studies abroad which otherwise would not be possible.

Another speaker warned of the proliferation of IRSIs and the need to concentrate efforts for better results. He suggested determining, on a regional basis, the different fields of activity and converting national IRSIs into specialized regional institutions to serve a wider base. Smaller institutions in the same field in other countries could become "daughter" institutions of the regional one, instead of duplicating its activities. UNIDO should play a role of coordinator to IRSIs at the regional or global levels. Further, the TCDC and the regional programmes are the best instruments to improve the productivity of IRSIs by coordinating their activities. The problem of duplication, and its effects, are not only present at the regional level, but in many cases also at national levels. An example was cited of an Asian country where three different institutions were preparing the same standards.

A staff member with experience with IRSIs in the Andean group agreed that one of the most important requirements is to define the objectives of IRSIs from the very beginning. The first five years are extremely important for survival. If it takes 20 years to show results we are dead from the very beginning. One has to live with the facts of life that in these countries, governments change every three or five years and we have to provide for the results within the first five years, and this can be done. Related to this is the matter of incentives. They found one of the biggest incentives for people to work in R+D was access to the important problems within their countries. Once they managed to gain this access, they were in business. This is a political decision and risk which governments have to take. The institute has to start at the very beginning with two or three large programmes that account for 80% of their work and build up an institute around such work, not the other way around.

Another consultant emphasized the use of twinning mechanisms, or linkages, to improve the performance and the operation of IRSIs. Twinning arrangements can result in, inter alia: a two-way flow of staff who begin to know each other and their problems; opportunities for training at advanced and technician's level, depending upon the need; the use of equipment which an institution does not, and perhaps should not, have because it uses that equipment only occasionally in the conduct of a research project; the opportunity to conduct techno-economic surveys where the expertise of an institution in another country can be brought to bear on that particular problem; the exchange of information; the joint conduct of R+D; and finally, the backstopping which a sister institution can provide, particularly to an institute in a lesser stage of technological or institutional development. It is a slow process but the arrangement can also help in improving management and administration and in establishing and exploiting linkages. There is no reason why the twinning mechanism would not be effective between developing to developing countries. One must realize the time involvement and recognize the cost. You also have to find a common problem on which to work. You have to focus on a specific project or specific need, and exert your energies to the successful accomplishment of that objective. The consultant believes that if more attention is given to twinning between IRSIs, twinning from one developing country IRSI to another, or twinning from a developed country IRSI, there can be a significant improvement in the performance of an IRSI which is having problems with obtaining facilities, staff, and opportunities to do research that they don't yet know how to do or have no mechanism for doing it.

One speaker mentioned the Japanese experience. For many years they were an under-developed country working without contact with the industrialized countries. A basic part of an education in Japan became the use of laboratories at the university. Every graduate engineer had extensive training in research and development and how to use equipment. He worked on developing products that perhaps already existed, but he was trained to know how to use equipment and obtain the confidence he needed to develop new products. During a 10-15 year period, they built up the backbone for the industry break-through which we saw 15-20 years ago in Japan. This suggests how we can use our research, our IRSIs in the developing countries. Perhaps each IRSI should put aside 20% of its time for short courses for engineers and technicians to come in and study how to use equipment for the benefit of industry.

A Deputy Res Rep from Africa commented on the question of regional institutes. In Latin America there is more basis for regional institutes than in many other regions, but in Africa there's been a very mixed experience. A regional institute cannot really function unless there is a genuine need coming out of the region for a cooperation and, unfortunately, you find such in very few cases. Most inter-regional institutes have been created through the initiative of development agencies or governmental organizations who have no money and who tried to tap the regional IPF, or similar sources. Therefore, in many cases he doubts whether they will be a solution to the problem. Nevertheless, as previously suggested, the twinning of an institute, or perhaps not even twinning but the exchange of experience between several institutes in the same region, or at the same level, should be encouraged. In the framework of TCDC, a lot could be done, and UNDP should make more funds available for this. It is also very important to identify your target group or client and that you keep that objective constantly in mind. He expressed his agreement that in Africa the big problem is human resources. In this connexion, turn-over in IRSIs projects is a serious problem. Of course people go in other sectors of industry and are useful to the country, but not directly to the institute. In many African countries, there's a tendency in these IRSIs to have more recruitment from the government side, not from industry, because it's easier.

A previous speaker explained he was referring to the necessity of developing regional institutes as sometimes it's the only way to reach a critical mass in certain areas to do productive work. They found that, if they declared from the very beginning that there were going to create a regional institute, they failed. Whenever they did it without saying so. i.e., working together on a problem and after three years specializing an institute in such a way that it became in fact a regional institute, they succeeded. Regarding the problem of losing people from this type of institute, again we come back to the objectives of the institute and planning for its first few years. In his opinion, one of its objectives should be to start losing people to industry after three years. This is one of the best ways of having people within the industry that are IRSI-minded and creating the network that will make it possible for the IRSI to survive.

As the session drew to a close, a section chief concluded that a critical issue, although not directly related to today's theme, is the question of multi-branch vs. single-branch institutes. There is no doubt in his mind that, if it's justifiable, establishing a single-branch or single-disciplinary institute is the way to go. In those cases where this is not justifiable, you will have to provide some type of services. There are many conditions where multi-branch institutes are necessary and this is the only logical way to go but single-disciplinary is the preferred choice. He wondered what the general consensus is on this point because this comes back to project formulation and the important of preparatory assistance. The Chairman suggested that the workshop should come up with the general conclusion that IRSIs have to be country-specific and it will depend on the country whether it can support a multi-function, multi-discipline, multi-branch or single-function, single-discipline, single-branch institution.

In summing up, the consultant tried to clarify the problem. In a small developing country where they have few institutions, one may choose to put several functions into one building under one directorship and it's confusing to call this a multi-discipline, multi-purpose, R+D institution. It is a multi-functional technological service institute, and that's justified, particularly in the small countries. As a country becomes more advanced, what they probably need is mainly mono-branch institutes to serve the various industries. With more developed countries, you may need multi-branch, multi-disciplinary research institutes in the real sense. Not service institutes, but research institutes, because there are many problems of such a nature that you need specialists from many disciplines to solve them. You may need computer people, electronic specialists, chemists, etc. If you want to tackle big problems, you need these multi-branch and multi-functional institutes. They have been a success in the advanced countries but one should distinguish between multi-research and multi-technology institutions. A lot of wisdom has been served up at this workshop and among ourselves and others we probably know all that needs to be known. But it's very difficult to apply it. He hoped that the conclusion from the workshop would be that we need a tool, a systematic approach including procedures and manuals, to assure that all this wisdom is actually applied, otherwise it will just add up to more paper on the shelves. It is not enough just to hand out a manual. It has to be a part of the systematic approach where you encourage and reward planning and reporting according to its framework.