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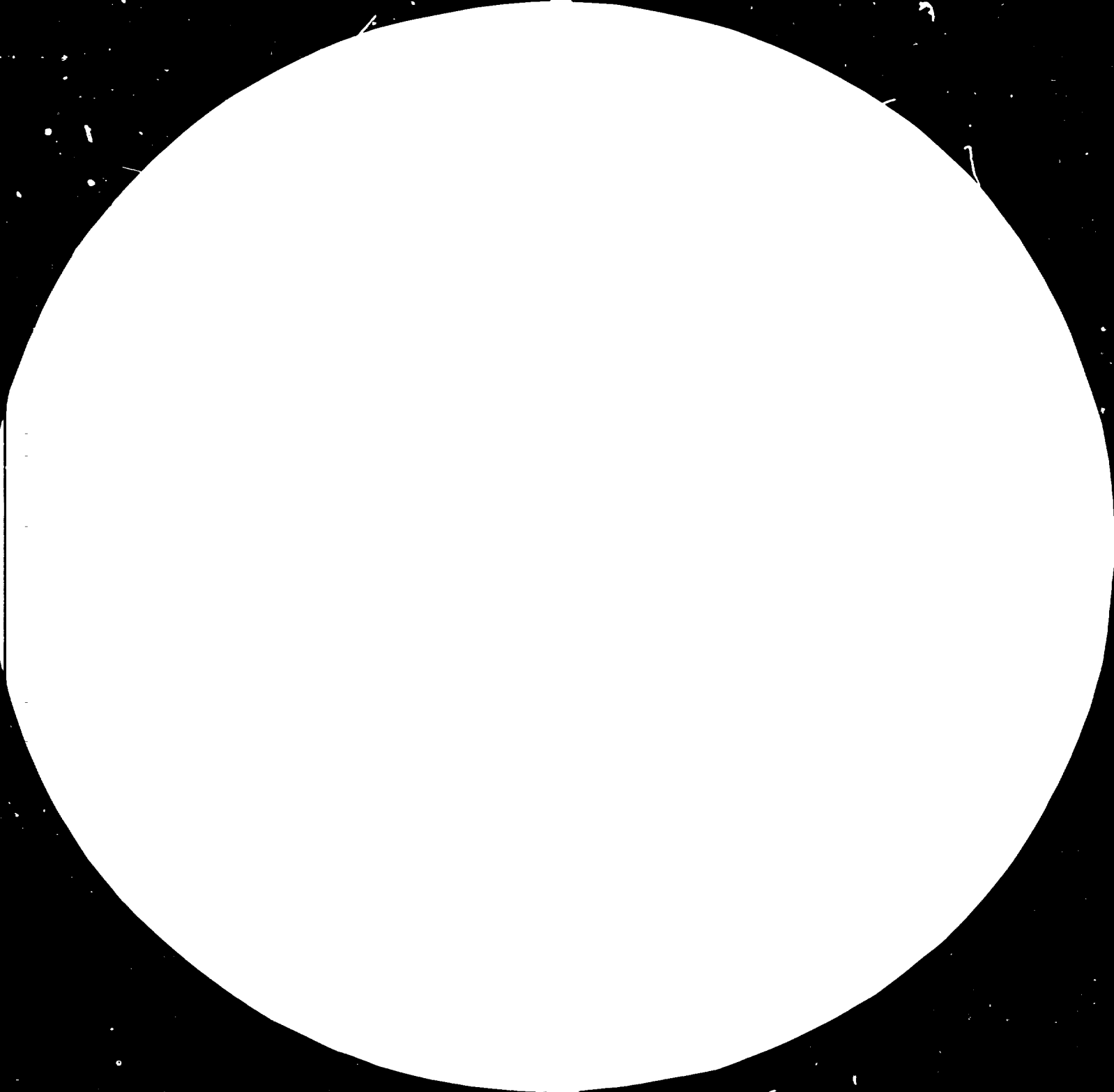
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Resolution Test Chart
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2 - 4 June 1980, Vienna

Effective Utilization of IRSI Services and
Research and Development Results*

(A summary of Theme III discussions)

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I. Explanation of Theme* - Dr. Joaquin Cordua, Ingenieria Financiera y Comercial, Santiago, Chile.

The theme of this final session has already been touched upon in the discussions of the last two days. This is certainly due to the fact we all recognize that the most critical problem concerning IRSIs is the very small impact they actually have on local industry and government. A large part of the work performed by many IRSIs seldom reaches the implementation stage, regardless of its technical quality. Many different studies about IRSIs agree in this conclusion. The final report of the "Joint UNDP/UNIDO Evaluation of IRSIs" made the following assessment: industry, in general, is often reluctant to use IRSI services other than for routine analysis and testing, quality control, etc., for a number of reasons, including: lack of information about IRSI objectives and functions; lack of confidence in IRSIs' knowledge and experience in industrial problems and competence in specialized industrial technology; belief that fees and costs are unreasonable; and lack of IRSI appreciation of the cost/benefit industrial motivation.

The same evaluation considered that in five out of seven institutes analyzed through field visits, the overall contribution made to industry was in the two lower categories of a five grade scale. Of course, most of these institutes performed much better than the one evaluated by a distinguished British engineer some years ago. He said during 16 years, not a single product or process developed by a 600-man IRSI in Asia was industrialized. Of the total staff, only four had previous industrial experience. Of the 80 projects under work, many were running for more than 10 years without evaluation.

If, instead of considering the amount of services supplied by the IRSI to industry, we look at the relationship from the other side, trying to quantify the fraction supplied by the IRSI of the total technology received by industry, we must also conclude that IRSIs' contributions have been marginal. One of the few quantitative studies about this subject was recently published by Professor Thomas Allen of the Sloan School of Management at MIT.** His data about the Irish industry agreed with the conclusions of studies made earlier by McGuire and Kentch in Australia and Ghirardi in Brazil. According to these three studies, the principal source of technology for industrial firms came mainly from other firms of the same branch, both domestic and foreign. The contributions which came from government-sponsored research institutes was less than 3%, i.e., 1.4 in Ireland and 2.9 in Brazil and Australia. Finally, if we look at the willingness of the users to pay for IRSI's services, including research and development, as a particularly meaningful indicator, we will also find that in the great majority of IRSIs, income from services is very low. On page 13 of the draft Programme Advisory Note prepared by the UNDP, we find that more than 80% of the IRSIs reviewed had income from contract work of less than 10% of their expenditures in a sample where 70% of these institutes were already operating for more than 10 years. In most developing countries, we certainly do not expect a full recovery of the cost of IRSIs. Nevertheless, in an IRSI that has reached a healthy relationship to industry and government, at least a 40 to 60% self-financing rate of operational costs should be expected.

* Also reproduced as UNIDO/EX 116, dated 29 May 1980.

** Thomas J. Allen, "Transferring Technology to the Firm: A Study of the Diffusion of Technology in Irish Manufacturing Industry" Sloan School of Management, M.I.T., Cambridge, Mass. USA, June 1977.

The evaluation report identified several reasons that explain the lack of real demand for IRSI services: in least developed countries, industry has not yet reached the stage of being aware of or recognizing the need for IRSI functional services; large scale and sophisticated industry in more advanced developing countries provide its own basic services and sometimes R+D; medium scale and national industry usually require basic services, but they have not fully appreciated the potential benefits of research and development, and governments in general have taken few measures to stimulate the effective use of IRSIs. Without discussing the reality of these statements from a practical point of view, an important issue is how we manage to adapt IRSIs to the characteristic of the existing industries and governments. The recommendations that follow are based on the need to introduce some changes in strategies, organization, and in the general approach of IRSIs to project development, so as to adjust the work to actual clients, with all their limitations.

One of the more effective ways to improve the utilization of IRSIs potentialities is the creation of a special unit whose aim is the marketing of IRSI services and research findings. The creation of such units very often comes only after the IRSI has been trying for years unsuccessfully to develop a clear relationship to industry. Considering that in developing countries most industrial firms and government institutions are not aware of the need of technological services, an aggressive promotional effort is absolutely essential. It is not easy to reach a good level of mutual understanding between an IRSI and an industrial firm. In fact, the perspectives of both parties are quite different. The industrial entrepreneur must operate at minimum cost, facing competition and changing market conditions, a situation that normally involves important risks. In order to succeed, he has to coordinate a large number of productive factors. Technology is only one of them and often he does not consider it the most important one. On the other hand, the IRSI is a non-profit institution, a public service. The basic motivation of its members is professional achievement. They have mainly a technical perception of problems, usually neglecting the economic and commercial aspects. Most IRSIs were created without a previous market study for their products. Certainly, it is not easy to carry out a meaningful market study for a new kind of service when it is necessary to persuade the future clients that they really need such a service. In most cases, an IRSI has to be already established in order to develop a demand for its products. That is the reason that many IRSIs are not the result of a feasibility study, but of the will of a government to foster the industrialization of the country through the supply of local technological services. But once the IRSI has been established, if there is not a systematic effort to identify what services industry and government are willing to use, the most likely result will be to end up generating products that nobody wants and in solving problems which nobody is really interested in. An important step in this process can be reached through the selection of the main functional activities of the IRSI.

An IRSI still in the stage of gaining confidence of industry should not devote more than 20-30% of its efforts in research and in the development of new technologies for its subsequent commercialization. The main part of the work should follow the "pull approach", starting from

the problems or opportunities met by a particular client, and attempting to work them up jointly with him, always using the shortest and least-costly way available. Sometimes this approach will include research and development, but in most cases the solution will be to buy and to adapt already proved technology. The accomplishment of a number of increasingly complex transfers of technology will give IRSIs the necessary experience to undertake more ambitious and creative tasks. Therefore, the main contribution that IRSIs can provide to enterprise will lie in an intermediate level, between research and development and the planning and execution of industrial projects as done by engineering firms. This intermediate area includes activities such as: venture analysis, consisting of market studies and a survey of the technical, financial and economic elements of new projects which, as a whole, facilitate an investment decision; comparison of alternative production processes from a technical and economical viewpoint; search for appraisal and selection of technologies, particularly as part of an operation of technology transfer; and adaptation of processes and products to changes in scale, in cost factors, in specifications of the final products and substitution of raw materials. Most IRSIs in developing countries do not pay the necessary attention to this type of work, but overemphasize the technological elements in industrial problems. Very often, this is due to the difficulties encountered by IRSIs in attracting and retaining professionals with industrial experience and with good techno-economic training.

The acceptance of transfer and adaptation of technology as a preferential field of work for IRSIs will probably meet some internal resistance. On the one hand, it may appear as an activity of less prestige than that of R+D. On the other hand, IRSIs have usually considered the creation of technologies required by local industry as their primary task and have visualised the transfer of technology as a competitive process, limiting the development of the local technical capacity.

The very serious difficulties met by many IRSIs in the achievement of an effective impact on industry should not lead us to the conclusion that IRSIs are not appropriate institutions for developing countries. Most firms in developing countries lack internal capacity for creating and adapting technology and governments also need assistance in this field. Therefore, the existence of independent centers capable of fulfilling these functions is indispensable for achieving a sound level of technical development. The very fact that several IRSIs succeeded in overcoming the gap which separated them from government and the productive sectors, shows that IRSIs can be both viable and useful institutions.

When we speak about marketing IRSI service, we usually think of the relationship with private industry but the process of convincing potential clients is very similar in the case of government institutions if the differences in motivations are considered. Thus, the task of a marketing unit in an IRSI has to cover all types of clients. The marketing unit in an IRSI should play a role of leadership, be in front of the organization, identifying viable new opportunities through advanced studies of markets for new products and potential uses of the resources of the country. It should also provide a practical commercial orientation for all IRSI programs, building an effective teamwork among technical, economic, and commercial specialists. We must remember that technology cannot be economically commercialized without a clear under-

standing by both parties of the situation and of the objectives of the other party, which means an effective two-way communication process. To establish communication is the main responsibility of the marketing unit.

Another measure that can improve the IRSI-industry relationship is the training of executives of industrial firms in management of technology, which means in the effective administration of technical knowledge as a productive factor. A special course on this subject will be held for Latin American countries in Chile next September, as part of the programme sponsored by the UNDP.

Now I would like to present the experience of two Latin American IRSIs that are seriously trying to overcome their lack of impact on industry. Both are multi-branch institutes of similar size with 70 to 90 professionals and annual operational budgets between 3-4 million U.S. dollars. At a time when the marketing function was strengthened, they were already operating for five and six years. The level of income from sale of service was about 10% of their expenditures. Initially, both institutes had practically the same organizational chart, in which about 12 technical units were integrated in four departments. Each department covered a specific industrial branch: food technology, chemistry, mechanics and electronics. In addition, both had a department of administration and finance. Marketing specialists were assigned to each of the technical departments. This type of organization originated the following problems: (1) The individual projects were generated at the lower levels of the organization, principally reflected the interests and personal capacities of the technical staff, instead of the actual needs of industry and government; (2) Due to the way the projects were generated, and to the lack of an integrating force in the institution (excepting the role of the director), no interdisciplinary work was performed; (3) In this kind of an organization it often occurred that the same people who generated the project, executed them and finally evaluated the results.

During its fifth year of existence, one of the IRSIs created a marketing group, reporting to the director. The main functions of this group are to stimulate a stronger marketing activity of the technical staff and to assist them in procuring contracts. Projects originated in industry are usually more complex, often demanding an inter-disciplinary approach. After the introduction of the marketing groups in 1974, the income coming from services sold increased sharply in this IRSI reaching a level of almost 50% of operational costs. The second institute recently designed a more radical solution to solve its isolation from industry and government. All the technical activities are integrated into only two large departments; one for marketing and project development and the other for operations. The main function of the first department is to identify potential users of IRSI services, to coordinate the formulation of the corresponding projects and to provide assistance in the contracting process, e.g., writing proposals, negotiating the contract, etc. The main function of the department of operations is the execution of the projects. The expected advantages of this type of organization are: (1) more projects will reflect the actual needs of industry and government; (2) a larger amount of income from services; and (3) the department of marketing, which is placed at the same level as the de-

partment of operations, will be involved not only in the selling of projects but also in the control of their efficient execution. This establishes a healthy system of check and balance between both departments.

The two cases just described are only examples of ways to reach a higher level of utilisation of IRSIs service. There are certainly others developed by successful institutions in other regions. But at the same time, the great majority of IRSIs in developing countries are isolated from their potential clients and are not devoting enough effort to overcome this gap. In this situation, I think that it's worthwhile that a larger amount of international cooperation be devoted, not to the creation of new institutions, but to the improvement in the performance of the already-existing institutes. UNIDO and UNDP could play a very important role in transferring successful experiences in the area of marketing of IRSI services and in supporting the necessary changes.

II. Introductory Remarks by the Chairman - S. Hable-Selassie,
Deputy Director, Industrial Operations Division, UNIDO.

The chairman delivered some opening remarks in response to the presentation of the theme by the consultant. From both the evaluation report and what has just been said, the picture regarding IRSIs is not a very encouraging one. The practical use which has been made of research results has either been negligible or not easily discernable. This is very surprising, because in the case of agricultural research institutions the situation is strikingly different in that developing countries have benefited considerably. The agricultural research institutions have done wonders insofar as agricultural production is concerned as in the case of the "green revolution". It is a historical fact that research and development and so-called technical progress were the factors, the decisive factors, in the industrialization of the developed countries, and one wonders why IRSIs cannot play a role in this process.

In view of this, one is tempted to make one of two conclusions: that the developing countries were ill-advised to set up IRSIs, or else, what has been done is a mere drop in the bucket compared to the real needs of the developing countries. Now the first one cannot be possibly true, because it defies logic. Therefore, one is inclined to the latter conclusion, namely that what has been done so far is a series of initiatives limited in their scope, isolated in their application, and perhaps hazardous in their implementation, so that IRSIs could not generally respond to economic and social needs of the developing countries. For example, there seems to be a greater bias towards pure research while the urgent need in the developing countries is in the area of choice of techniques in order to develop labor-intensive technologies and thus do something about the urgent unemployment problem in the developing countries.

Related to this same issue is the question of the role that IRSIs could have played in the area of pre-investment studies, i.e., a feasibility study which leads to the choice of a particular technology and which establishes its viability given certain social and economic parameters.

Therefore, the linkage between IRSIs and industrial development centers must be one that could, to the benefit of the developing countries, be further developed. There are also other linkages to which reference has been made, particularly with a view to ensuring the relevance of research and development efforts to the industrialization of the developing countries. In particular, the chairman had in mind the technology development organizations which have been suggested in the joint evaluation study and Dr. Cordua's marketing units as part of the structures of future IRSIs, in order to enable them to respond better and to strengthen the link between industry and IRSIs.

There is one other issue which has perhaps not been dealt with extensively in both the evaluation paper and in the introductory remarks and that is the question of the staffing of IRSIs. While open to correction, the chairman suspects that IRSIs are mainly and perhaps exclusively staffed by scientists, engineers, technologists and do not have the multi-disciplinary skills required to be able to perform their broader functions, referring particularly to the absence of economists and social scientists. If correct, IRSIs could not possibly be expected to do an adequate job of linking the work of IRSIs to national planning objectives and also to the marketing of their services. If IRSIs are to do those things which are important and which make their work relevant to national-economic objectives, then they would need to be strengthened with an appropriate multi-disciplinary team. Of course, this would have implications for the thrust and content of future UNDP/UNIDO technical assistance.

III. Panel Discussions*

The panel discussion was opened by a staff member from UNIDO's International Centre for Industrial Studies who noted that most speakers have pointed out that the IRSIs are showing a relatively poor performance, poor measured to what the "ideal" IRSI would be like. We know that the large companies usually are rather skeptical of IRSIs. They don't trust them and prefer to build up their own capacities, buying information and technology from outside if they can. The small companies are not geared to using outside institutions to the extent that would be expected. We have all seen that in research institutions, activities are going on that have little relevance to what industry requires. Against this background, in the future one will see an increasing need for services of the kind that IRSIs should be performing. Not only in the developing countries, but also in the industrialized countries, public support to industry is increasing in the fields of technology, foreign marketing and various technical services as a means to maintain and increase international competitiveness. It is a very crucial element of any country's industrialization process to keep abreast of technology developments and to make use of them in its innovations.

The question which this workshop should address itself to is: can we develop some kind of a standard procedure to increase and measure the performance of IRSIs? Is there a standard IRSI that we can have as

* Those portions of the panel discussions most relevant to the theme are summarized herein. Panel participants included: E.T. Balazs, IOE/MET; A. Eraneva, IOE/AGRO; V. Gorbunov, IOE/INFR; H. Janisjewski, ICIS/TEC; R. Lalkaka, IFSTD/UNDP; and H. Muegge, ICIS/GLO.

an ideal set-up? Everybody knows that there are no cheap tricks in this game but there are some proposals. First of all, there is the need to look at the entire infrastructure or network in which the IRSI is going to operate, or is operating. That includes all the way from the academic or basic research to the actual design of processes, marketing of products, and the management of plants. It might be possible to look at what is the "standard" network of a given country at various stages of development. A network that would cater for all the technological information services and see if one can use some kind of a standard analytical kit to review a country's performance and its institutional set-up. Then one could insure that the particular IRSIs that one has decided is missing in this network plays the role that it should.

Inside the country, the critical and well-known problem is that the customers are not convinced about the need to acquire the services offered by IRSIs. Generally, it is UNIDO's experience that industry must get the feeling that they own a particular IRSI, that they are a part of it. A case was cited where the main customers were placed on the Board of Directors of an IRSI. This happened to be an industry with a number of large public companies, and the directors of these companies were in on the Board of Directors of the IRSI. There was a sudden shift in the interest of these companies to use the services of the IRSIs. In Sweden, there is a scheme where the linkage to academic research is done by having a network of contact persons. These contact persons are paid by the National Board for Technical Development, and they are placed at various research institutions to keep track of what is happening there and to create a linkage to the Board and, through the Board, to industry. To summarize, in the future, UNIDO/UNDP should try, in a more systematic way, to analyze the entire industrial network of the various countries, the network of technological and other services. One tries in this network to see also that sufficient financing is given. Sometimes industries are perfectly capable of carrying out activities that now we think only IRSIs can do, and support to industries in their innovation process through financial means may be another alternative. Finally, one may think of establishing some kind of a module system for IRSIs. IRSIs are not one particular animal, they cover all types of activities. Perhaps one could devise a module system where one says for a particular purpose this is how let's say units dealing with contracting support could be established in a particular country.

A New York participant, a former SIDFA, opened his remarks by stating that research is only the tip of the iceberg, representing perhaps only 10% of the total effort in the pyramid of activities leading from the identification of a need or problem to its ultimate solution. The balance is the tremendous endeavour to scale-up laboratory results, to test and retest product prototypes, to prepare demonstration or pilot plants and, finally, the complete corpus of feasibility, design and engineering studies leading to the installation of a new plant. It is clear that the research effort has not been fully integrated with the balance, leading to ineffective results. Why are these research results not being translated as rapidly and as effectively as they could be? First of all much of the research programmes of IRSIs are irrelevant to real needs. It is irrelevant because in preparing the research plan there is no real consultative machinery. The industry,

the end-users, are not involved as effectively as they should be in designing the middle and long-term work plans of the IRSIs. Secondly, the leadership of the IRSIs in the developing countries is largely in the hands of what he described as "indigenous foreigners", i.e., highly-trained scientists who have received their basic education and experience abroad, who have come back and found themselves totally divorced from the real needs of the industry or of the productive sector.

What are these real needs? They are to improve the quality of life, the utilisation of natural resources, development of energy resources, and so on, and IRSIs are typically not tackling these type of problems. There is a strong move away from this kind of set-up, and ASTRA was cited as an example of an organization doing some excellent work. The Application of Science and Technology to Rural Affairs is a group of academics working out of the Indian Institute of Science in Bangalore who discovered that all their instructions to their students and all the research that they have been doing in the past, has been irrelevant to the real needs of the countryside. This group has gone out into the villages, tried to identify problems and not just suggest solutions, but take the solutions through a step-by-step process of extension and orientation until the results are actually applied. It is quite clear that research workers are not good salesmen and are reluctant to step out of their air-conditioned research laboratories and reach the people where their services are most needed. Therefore, the suggestions made of setting up a research contract section, of setting up a technological services section in a research institute as an essential element in its organizational structure, is indeed very relevant.

This IRSI evaluation exercise has probably been one of the best prepared and the most comprehensive seen for a long time but some of the results that came initially from the IRSI evaluation studies caused great concern to the speaker when in the field as a SIDFA. When the mission report of the IRSI evaluation team which visited a leading institute in his country of assignment reached him, he was frankly appalled. For four years, the Resident Representative and SIDFA had been trying to persuade this IRSI to get out into industry and work on "real" problems. Those problems were: the industry was operating at less than 40% of its installed capacity; there were no spare parts; there were no imported raw materials; energy consumption was high; yields were low, etc., and yet, the mission report said that the IRSI was right and that the Res Rep and the SIDFA were wrong, or were misguided, in trying to persuade this IRSI to work more closely with industry and that, in fact, the IRSI should concentrate on national problems of a long-term strategic nature and should not deal with the day-to-day problems of the industry. Those problems should be dealt with by the industry itself. The speaker admitted to putting the case in rather bold terms and that it was probably not stated quite as explicitly, but they had a hard time convincing the research institute that this was really not what was meant when the evaluation report finally reached them.

This speaker also commented on one of the transfer mechanisms - the so-called pilot or demonstration plant - noting that there seems to be a great push towards setting them up. The IRSIs may have some role in developing countries where industry doesn't have the resources

to scale-up from a research result to a commercial installation but, by and large, the pilot plant is something that needs to be avoided by the research institutions, or, at least, installed only with clear prior identification of a prospective partner. Only when a business enterprise has expressed some interest in scaling-up a particular process and only in partnership with that interest should the laboratory undertake to set up a pilot plant. Otherwise, the average IRSI does not have the skills, does not have the capacity to design and operate a pilot plant which is also an extremely expensive business. This leads one to the role of the consulting-engineering organisations. For the last 10 or 15 years, we have been talking endlessly about research as if it were some kind of an "open sesame" to industrial development. If the same effort had been devoted to creating and strengthening industrial consultancy organisations, perhaps the results might have been much greater because the industrial consultancy organisations are the most effective catalysts for change, the most effective organisations to translate research results into actual designs, engineering and commercial installations.

One of the activities of UNIDO in the field which have had very high payoffs have been the series of seminars relating to university, research, and industry linkages. A series of them have been held and have been most effective in bringing the universities, research organisations, and industries in very close touch with each other, and this is something that might well be carried forward. Finally, in the discussions one rarely hears the word "adaptation", the adaptation of research results or of know-how that is imported, and rarely have we had much opportunity to talk about the import of "know-how" because this really is an area where the IRSI has an important role, but in most developing countries the IRSI has been kept out of all the negotiations for foreign know-how. There is the example of Japan which over a period of 8 or 10 years spent 2-3 billion dollars in import of know-how. In a highly selective way, the best know-how available in the world was bought rather than developed from scratch in the country, but the important thing is not that 2 or 3 billion dollars was spent in searching and buying the best know-how, but for every dollar that was spent in searching and buying the best know-how, \$7-8 were spent adapting that know-how to the local conditions, to improving and building on that know-how and becoming the leaders in that particular field. This 7-8 dollars, building upon the \$1 of know-how that had been purchased, is perhaps the true role of IRSIs in many situations.

The Head of UNIDO's Metallurgical Industries Section noted that his group has implemented 12 projects during the past nine years related to IRSIs, in nine countries with an overall value of \$11.5 million, rather significant in terms of the \$55 million as the overall value of all these types of projects being financed by the UNDP. These projects were all single-branch projects and most of them were connected with single-branch institutes. He makes a distinction between the single-branch institutes and single-branch projects because some of the projects were carried out by a single-branch division in a multi-branch IRSI. Repeating an earlier comment, he noted his belief that it was a fundamental omission in the methodology of the evaluation study that from the beginning it did not make a distinction between multi-branch, multi-purpose institutes and single-branch institutes. In his opinion, a very small part of the discussion so far relates to the specific and

more simple problem and where the greater results of UNIDO's and UNDP's work has occurred, namely in the single-branch institutes.

Referring to Chapter V of the study on "Expanding IRSI Services - Alternatives and Complementary Choices," which he considers as perhaps the best part of the study, and particularly paragraph 340 which starts with the following: "IRSI's can provide invaluable services to government in such areas as sectoral surveys, techno-economic opportunity studies, utilisation of raw materials, etc., as these have a potential for impact on national development objectives of increasing industry inputs..."- the speaker believes it is a very important aspect of improving the efficiency and the support to be given to the institutes, and that this subject be included both as a policy objective and also as one of the important functions which are listed in the first pages of the study. Their section projects, dealing with single-branch institutes, were not imposed on the industry by Government or from somewhere outside. There was no such situation that after having established this type of institute - you have to look around for clients or contracts. This is a different type of animal, a different type of problem, which once more underlines that a distinction has to be made between these two types of institutes.

The role of intermediate institutions between IRSI's and clients, such as consulting and engineering firms, has been mentioned. The speaker cited an example of one organization where the research and development institute operates jointly with a design institute. Design and research and design and development institutes are functioning in many countries and are integrated into industrial branches. This type of institute has been operating successfully in his home country, within the framework of the Hungarian Aluminium Corporation. There has never been a problem with finances. The problems were that the demand for work have always been greater than the institute was able to provide. There was no need for a marketing section or marketing activities. There was no specific need for interchange of staff, ideas, methods, training, etc., between the industry and the institute, because this was within one corporation, and the institute budget was part of the budget of the corporation. Somebody may say, what is typical, acceptable or suitable for Hungary may not be suitable for another part of the world. On the contrary, this type of approach has been pursued by all the big multinationals in this branch of industry, a multinational like Alcoa or Kaiser or the big steel companies. They have these type of complex institutes which comprise research and development work, design, consultancy, preparation and evaluation of studies, etc. The best people from these bodies are permanently involved in the development of industry, in negotiations with foreign partners, in all the basic and important technical or substantive decision-making processes. Somebody may say well yes, but can a developing country afford it? Not always, but there are industrial branches which are fundamental for some type of developing countries, where there are existing industries or development plans. There are developing countries and there are branches of industries which justify immediate results without years of preparatory investigation. Naturally starting an establishment is not the beginning of results. As already mentioned, it's starting with the basic services moving to the more important services which are planned for general supporting of an industrial branch.

Concerning design, selection and administration of research projects, particularly concerning UNIDO's activities in designing and selecting this type of project, the speaker referred to the draft Programme Advisory Note prepared by UNDP on the basis of the evaluation study. From the point of view of designing and selecting of UNIDO's work, some parts of this Programme Advisory Note need to be revised. Specifically, Chapter 5, "Considerations for Project Design," and Chapter 6, "Prerequisites for UNDP Assistance in the Establishment of an IRSI" - serious additional work has to be done to revise these chapters because they provide advice to one specific type of IRSI which does not cover the majority of projects carried out in the field of strengthening the institutional servicing and development, and research in the industrial field. In paragraph 6.1* up to two years preparatory period is set as a requirement for UNDP to decide on whether to provide assistance to an institute which is requested by a government. Reiterating that for a single branch institute in a developing country which has its existing base or is developing a large-scale industrial basis, a section which has been implementing this type of projects for \$11 million over the past 10 years really doesn't need two years. We need three months and not more. He expressed concern that in putting everything under one umbrella, we shall just lose the opportunities to assist in those cases where our assistance is well justified and required. In para 6.2.6**the existence of the buildings for the institute is set as a precondition. He questioned that when all the preparatory parts within the project of selecting the profile, selecting the laboratory, putting up the specifications of equipment, maybe a pilot plant is justified, how can one provide the building as a prerequisite of starting all these things? It should be the other way around.

The proposition that IRSIs in developing countries are isolated from the industry on the one hand and, on the other, the industry operates in isolation from existing IRSIs, was picked up again by a staff member from the Development and Transfer of Technology Section. This obvious situation is not necessarily characteristic only of developing countries. The friction, or the lack of communication, also exists in many industrialized countries, although perhaps the gap is much stronger in the developing countries. Why this situation exists or why it happened is fairly well covered in the study and was summarized by the consultant in his introduction of today's theme. The speaker suggested that one of the reasons for this isolation and lack of interaction may be the structure of the expenditures or the overall orientation of IRSIs towards so-called "basic" and "applied" research, one being more scientific in nature, the other being much more industry-oriented. Recalling a study which analyzed the expenditures for applied and basic research in developing as well as highly-industrialized countries, he was stricken whereby in industrialized countries the applied research had a priority in terms of expenditures, but in developing countries the situation was reversed. In his view, this is a very unhealthy situation from the point of view of utilisation of IRSIs' capacities by industry. This situation also has a certain bearing on the status of the research workers in developing countries, and throughout the world. Rightly or wrongly, they often consider themselves as above certain issues, above the dirty work

* Which reads "It is desirable that the government's plan to create an IRSI should begin with an advisory mission followed by a preparatory period which could be as long as two years and during which a second preparatory mission would be envisaged to plan the establishment of the IRSI."

** Which reads, "The IRSI will have available to it the required buildings to start its operations and to house those functions and modules which are to be its starting nucleus."

which is being done at the industry level. It is clearly a psychological phenomenon with which we have to deal in some way. A relevant point is that IRSIs usually are subsidized and are not operating on a self-supporting basis. This naturally leads to the tendency by many IRSIs to devote their efforts to basic research, to clean-cut scientific work, because they know that there is a certain budget allocation by government, usually in developing countries these are government-sponsored institutions, and they therefore don't need to worry about their daily bread.

On the question of involving IRSIs in the process of importation of technology into the developing countries, the speaker suggested that it is a very crucial problem in terms of utilisation of the existing capacities in these countries. But here again, adaptation work is "applied" research. In these circumstances, a government has a very substantial role to play. In a traditional pattern of technology flow to developing countries, it goes from the foreign supply directly to the industry with IRSIs being left aside. In many countries, however, a new pattern is developing, namely that the government is actively involved in regulating the conditions under which a technology flow takes place and here one of the issues which government usually looks into, apart from the contractual aspects, is the matter of rapid adaptation and absorption of technology with the ultimate goal of mastering a technology. In these countries, industry is forced by government regulation to use IRSI services in the process of adaptation and packaging of technology and attitudes are thereby changed. While this is not the only answer to the question of using IRSI services in the importation of technology, perhaps it may teach certain lessons, or show certain possibilities for the utilisation of IRSIs in this process.

The Interregional Adviser on Metallurgical Industries expressed disappointment and surprise at the documentation for the workshop which gives very extensive examples of those institutes that have not operated successfully, or have not produced good results, but does not mention institutes in developing countries which have been successful and have justified the expectations or establishment of such institutes. During the last two decades something like 400-500 institutes have been set-up in developing countries and only a very small fraction of them have received any tangible UNIDO or UNDP support. In India, for example, in the last 20 years something like 30 institutes of different disciplines have been established and some of them have done excellent work. The speaker urged that one should not take a negative attitude in making an evaluation of the type just conducted. It is not only the developing countries which suffer from a lack of dialogue or communication between industry and the research organizations, the developed countries also are in the same pattern. There is no difference between the two sets of countries and painting the developing countries with a brush of tar, saying that they are not competent, not capable, and are doing everything wrong, is not correct.

Referring to the draft Programme Advisory Note, he cited para 6.1 (see footnote on page 11) where a recommendation has been made for two years preparatory assistance, possibly followed by another preparatory mission to plan the establishment of an IRSI. If this is universally followed for all countries, regardless of their stage of development,

it will lead to total disaster. Many of the countries will certainly withdraw their request for UNIDO or UNDP involvement. Each country, each region, must be appraised on its own basis whether or not it has been preceded by the six prerequisites cited in para 6.2. Particularly unacceptable is para 6.2.6 which requires that the IRSI will have available the required buildings to start its operations. The speaker mentioned two sets of modus operandi based on Indian experience in establishing IRSIs. In one case, the director was first selected and the laboratory buildings were built around him and his team of workers in the nuclear field with very good results. In the other case, the buildings were established after reasonable consultation with the experience of advanced and developing countries. The director was elected at the same time and the staff assembled and the two go hand in hand with equally good results.

The UN should not try to introduce bureaucratic machinery to complicate the system to such an extent that the developing countries might say, "Thank you very much, we're quite happy to do it ourselves." What is needed is a balanced approach, a balanced analysis. There is no point in putting out documents with a universal yardstick to be applied. We cannot say that South Korea or Brazil or India will fall in the same pattern with some other countries. Each case has to be judged on its own merit. It is possible to have a preparatory assistance, fine but there are institutes which have had none and there are institutes for which it is not necessary. In Colombia and Thailand, for example, with which UNIDO has been associated, the IRSIs have passed through difficult waters, passed difficult periods, making mistakes but they have learned from them. Urging a project of learning, he advised the workshop not to be disheartened by the documents presented which have underplayed the successes and is not all the story. There are many other ways and means of bi-lateral and multi-lateral collaboration systems which have and will continue to yield good results.

A UNIDO staff member, dealing with IRSIs on a day-to-day basis, fully supported the previous discussion on the managerial aspects of IRSIs. In most cases, good management is critical to success. Nevertheless, it is not possible for the UN to pressure the government to take some actions such as changing the national counterpart, the national director. It can only create great difficulties. Referring to a case which was mentioned yesterday, he agreed that the director of the institute is not a man with outstanding initiative, but he's a very good research worker. What can we do from our side? We can and did send a very good project manager with initiative. The speaker cautioned about the dangers of making public such an assessment. The case in point is a negative one, but the government authorities consider it quite satisfactory. Regarding financial aspects, he did not see a problem because bi-lateral development agencies, for example, CIDA in Canada and SIDA in Sweden, are ready to assist in every reasonable and realistic case. Regarding training, the language problem was not mentioned. Good experience with twinning arrangements has already started further work in this direction by IOD/INFR. In any event, it should be stressed that the period for the establishment and development of IRSIs should be much more than for industrial enterprises and, in any case, more than five, six, or seven years.

The next speaker, a staff member who has backstopped a number of textile (single-branch) IRSIs, did not understand a previous speaker's

expressed concern that the evaluation did not cover successful institutions because it is only by studying the unsuccessful ones and the reasons why they are unsuccessful that one can do something about improving them. On the other hand, he agreed that it would not be possible to have a standard model and apply it universally.

Concerning the issues raised in the workshop, in his opinion it all boils down to the linkage with industry. In institutions where this linkage with industry is well-developed, there are a few problems. It is the institutions which have been created without the effective involvement of the industry to be served where the problems have arisen and he is skeptical about the chances of solving or ameliorating these problems through international action because the solution to the problems is largely in the hands of the governments concerned. Usually, IRSIs in developing countries have been established and are run by government, whereas industry, in many cases, is in private hands. Another problem is that the institution is not under the Minister of Industry which creates further problems of communication. The fact that the IRSIs are usually government-run is the principal reason for many of the problems that have been listed here, and certainly his experience with textile institutes bears this out. The staff of such institutes are government employees with a different salary structure and entirely different terms of employment. Very often they have been recipients of government scholarships with the obligation to work for the IRSI for perhaps twice the number of years that they studied abroad. This creates an atmosphere which is not conducive to cooperation and/or enthusiastic work. There have been several examples of this among textile institutes that have subsequently requested UNIDO assistance. This assistance in many cases has not been very effective because we have little means to impose our views on the government. For example, we have been preaching for years for increased involvement of the private industry in the activities of the Turkish Textile Center but it's been resisted and there is nothing we can do about it. An institution designed to serve the industry can only be successful if the initiative towards the establishment of the IRSI comes from the industry itself and rests on the actual and realistic needs of the industry. A sizeable industry in any sector usually needs a central institution to provide certain services which would be too costly for every single production unit to carry. There are examples of this as well, the two textile centers in Egypt where IOD/AGRO has been involved are a very good example of a situation where the industry has initiated the establishment of them and is actively involved in designing the work programme of the institution, deciding upon its staffing and other resources and, in doing so, they make sure that whatever comes out of the institute is fully relevant to the requirements of the industry and is being used by the industry. So there are opposite examples, but common to all of these is that they are only successful because the initiative has come from the industry itself. To turn the situation back in those cases where an institution already exists and is withering away is really very difficult.

Notwithstanding all this awareness of the problems that arise from this lack of industry linkage, as amply demonstrated in this workshop, UNIDO is still facing serious difficulties in getting this message across to governments, UNDP and to its own SIDFAs. He illustrated his point by referring to two recent project proposals which come from governments

for establishing new institutions which have a large enough textile industry to warrant their existence but, in both cases, the industry's needs have not been elaborated upon and it is uncertain whether the industry has been thoroughly consulted, if at all. Yet, he is expected to dream up a project document for a million dollar project here in Vienna, and when this has been resisted he made himself highly unpopular among the SIDFAs and Res Reps who have shown little understanding of the project formulation procedures which are certainly not new. They were distributed over five years ago in the form of a UNDP manual which clearly sets out what the logical sequence of events should be. First, you establish the needs of the industry. Based on those needs, you work out a programme for an institution, and when you know the programme you can then determine what the staffing and other resource requirements are for such an institution and this you break down into government consideration and UNDP consideration. The rest is very simple. You just put it in the form of a project document, but you have to work it backwards, i.e., from the requirements of the industry it has been said here that the building must exist first, but that is really putting the cart before the horse, as somebody has already pointed out. It seems very simple, but it is surprising that so little appreciation is shown for this proper and logical way of proceeding. He suggested that one reason might be the anxiousness to spend the IPF allocation within the country programme and the figures don't look nice if the money is not spent the way it was first set out. While we want to do that, we'd also like to spend it in a proper way and there is the conflict. It's a bit of a heresy to mention it, but it exists all the same.

The UNIDO evaluation officer explained that it is true the sample of IRSIs was limited and for a number of reasons. First, UNDP, which was putting up a sizeable amount for the evaluation exercises, insisted that the projects be UNDP-funded projects for obvious reasons. Even so, in Phase I, where we looked in depth at 28 institutions, two known successful IRSIs were ones which had not received UNDP/UNIDO assistance. There were other institutions in the desk studies sample that were also considered successful. Several of them were located in India and were successful largely because the Indian Council for Science and Industrial Research (CSIR) had combined them with the industry they were to serve in a very effective planning, programming, financing and management mechanism. Therefore, it is not correct to say that the report is based only on failures. Perhaps there isn't enough distinction between the multi-branch and the single-branch IRSIs in the report, and some of the critical problems identified may have less impact, as a generalization, with single-branch coverage institutes than they are with multi-branch, but one shouldn't be too defensive about this or over-emphasize such differences because they are only differences in scope, not in type. The whole objective of the exercise is to find out how we can improve the effectiveness of our assistance to the developing countries which after all, is the name of the game. It's not using up the IPF for industry projects, it's helping the developing country move towards industrial development. There have been mistakes made in the past by single and multi-branch IRSIs, some very costly and time-consuming, which can and should be avoided in the future. We have recorded these mistakes. We tried to synthesize them into useful guidelines and generalities that will help governments determine their specific country requirements and yet draw on these lessons of experience from countries at similar levels of development, where applicable. It's obvious that many of these

institutions, however you want to grade them and by whatever standard, are not yet living up to the potential they have to contribute to industrialization. Rejecting the findings of the joint exercise on the specious argument that every country is different will not make much of a contribution to improving the quality and relevance of our technical cooperation activities.

The discussion then turned to the use of pilot plants by IRSIs where success has been mixed and, as a very expensive investment, their use should be carefully considered. One speaker felt there is confusion with respect to the definition of pilot plants and that many people mean laboratory scale equipment for demonstration and similar uses. It is necessary to identify what is really meant because an industrial pilot plant is an entirely different kettle of fish and he is doubtful whether there is any IRSI in a developing country which is even capable of supporting such a pilot plant.

Another staff member spoke of pilot plants as a capital investment, with the return of investment guaranteed through sales or production and questioned whether we are talking about pilot plants, promotion plants, or production plants? The idea of a pilot plant in developing countries is not meant to find out the mistakes, but to make the mistakes. This is done all over the world, e.g., the Canadian Asbestos Industry would not start any big process without having a pilot plant which costs more than \$2 million. The so-called pilot plant normally is meant to be a small production unit, with the emphasis on process development, state of production, applied R+D, selection of projects for industrial and consumer goods, and market research. It is probably more accurately described as a promotional plant. In developing countries, such a pilot plant can be established but it has to make a profit in order to return the investment capital back to the government. The introduction of such demonstration units to the private sector is considered not more than the visual results of R+D. Without having the guarantee of being a part of the industry itself, from his experience, pilot plants have been a waste of money and effort when attached to institutes as a means for industrial development in the private sector. It is, however, of great value when industry uses the extension services of an IRSI as an advisor on the application of an industrial process within an industry. Many industries are willing to put pilot demonstrations in their own plants if the process for such a demonstration or promotion is deemed to have sufficient profit potential. In this case, normally the size of such a pilot operation is based on semi-industrial laboratory investigations. It is therefore self-explanatory that the use of the term "pilot plant" has no standard meaning and the use of pilot plants has to be approached with cautiousness, particularly for IRSIs.

A UNDP field staff member was attracted by the term "critical mass" which appeared in the report and which he assumed meant the inputs needed in a pilot plant or IRSI which would enable it to function effectively. In situations of severe financial constraints some countries cannot afford to support a complete pilot plant or IRSI but the government, keen to solve some of its urgent problems, accomodates and says alright, let's go ahead with only a quarter. Unless all the inputs in the IRSI are there to solve a certain problem, it will never do. You need a good director in order to launch a certain programme but what can a head do without the prerequisites for this creation of the critical mass? If we tell governments that they have to wait another 20 years for IRSIs to

help solve critical problems, their support will be questionable. Perhaps one of the solutions is "twinning", but it hasn't worked in Egypt. They tried it in electronic industry and approached Siemens, who said sorry, we cannot be in any way associated with this. They also tried Bulgaria, but two years have passed and nothing has happened. He asked, "Where is the solution?" Egypt has immediate and emergent problems that must be solved and here we are confronted with the situation where IRSIs will not be able to help, even after 10 years, and the expectations of the government is that those IRSIs should be able to help them soon in solving those critical problems.

The consultant from Norway and former UNIDO project manager talked about the mission or role of R+D institutes because there seems to be so much misunderstanding which sometimes results in judging IRSIs unfairly, expecting them to do something that they can't possibly accomplish. When it comes to product and process development, it's quite obvious that an IRSI cannot produce turn-key, large-scale industry. It's never been done in a research institute. It's not their job. It's their function to participate in this work together with industry, indigenous or imported. If a country wants to have a plastic factory, they don't go to the research institute to reinvent the wheel. They'll have to invite somebody to establish a plant. If you tell the research institutes to develop that sort of thing and set-up pilot plants, you waste a lot of time and effort. You'll probably never get what you want or, if you do, it will be expensive, come late and probably will be inferior. We have to realize this. It's a pity that the world is like that, but that's the way it is. Today's technology is very complicated, it takes hundreds of experts to design a factory. A good engineering company has at least 300 engineers. How can a small research institute possibly do anything of that kind? What it can do in terms of product development is to develop smaller things like electronic gadgets, the xerox machine, and things like that but usually it should not develop anything unless it has an industrial partner, unless there is a target industry which can participate in developing the product or process. In that case, there is no problem selling the result. The result is sold before you start because there is an industry with demonstrated interest. It is a big mistake, repeated all over the world, to try to invent products made from local resources which maybe are not very suitable for anything. What IRSIs can do is survey and analyze the resources and contact industry on the results, make economic feasibility studies on what can be done with them - but not start process and product development before knowing whether there is enough raw material, whether it can be transported, and whether there is an industry which can use the process or product and is willing to participate in its development.

The policy objectives of an institute should provide guidance on things that should and should not be done. In this connexion, the speaker referred to the evaluation team report regarding the Materials Research Division of the MARMARA Institute, where a previous speaker said that we told them they should do long term strategic research, rather than deal with the problems of industry. This was not the intent and is a misunderstanding. What we wanted to say is that the MRD should not do the day-to-day, trivial and production-related things like quality control, helping people to select the right tools, etc., because there are thousands of small industries who lack knowledge, lack skilled people

and equipment, who lack this and lack that, and for a country to help these industries, they need other tools than IRSIs. They need industrial development corporations, industrial estates, field advisors, better educational systems, soft loans and many, many other things - but they hardly ever need research. When they do need research, it would be after these other service organisations which look after the small industry discover that they have a common problem. Maybe they need some glue, some varnish, some services that become a problem to several of them. Then these institutions looking after small scale industry could come to the IRSI and ask for help in solving a particular problem. An IRSI can help them to apply the results, but you must not tell the researchers with PhD's that they should go down on the workshop floor and do the job of a foreman or a lower level technician, because it's a very uninteresting job and they're not even qualified to do it. A research institute's skills are developed by the work it is doing. If you put them to do trivial work, they'll very soon be trivial, because all the good people will have left and the whole thing will deteriorate. If a country has a sophisticated IRSI like MARMARA, it should also do some strategic research, yes, because Turkey is after all a fairly developed country with ambitions, and if they don't look ahead they will probably never solve their problems. If an IRSI is too absorbed with solving the day-to-day problems, it may in the long term be doing a disfavor to the country.

In respect to pilot plants, it is just silly to put together different pieces of equipment so you can have one. Of course, they are needed for food processing at the bench-scale and sometimes even larger. If you have a tanning laboratory you also need a demonstration plant. If you have a textile laboratory you need a pilot plant so you can try out new materials and processes. That's not what we're against, but what we are advising against is believing that an IRSI can produce turn-key, large-scale industry by having pilot plants, because that is a total waste and absolutely futile. Unfortunately it is tried in many places and IRSIs are blamed for not doing this, and when it is said that some institutes are failures because they haven't produced any new products, this is unfair. They should not be expected to produce new products, but they should be expected to participate with industry in developing these products. They should be expected to do all kinds of surveys, testing and analysis, consulting, etc., but not to develop new products and processes by themselves.

Another Section Head explained that when one talks of a pilot plant in industry, it is an operation set up to explore and develop a new process by simulating production at the smallest possible scale so that the results are still meaningful and based upon which one might venture and build a plant. This always involves experimental work. Very often people confuse this with what the speaker defines as pilot-sized demonstration plants. For example, quite often you put up a small foundry in an IRSI. It is not a pilot plant at all, rather it is used for training and demonstration purposes. It can be used to evaluate local raw materials but basically it is a pilot-sized demonstration plant. Pilot plants almost exclusively relate to the evaluation of processes involving local raw materials that are unique in their properties and established industrial processes are not directly applicable. For example, in Indonesia they may have some tropical fruits that they don't know how

to can, that really is a pilot operation. Or to make pulp and paper out of a wood species which is quite different from what a normal paper-making technology is based on. In this regard, these pilot plants are essential to develop a country's industries and the utilisation of local raw materials. Nevertheless, the pilot plant is not always or necessarily the logical, least expensive or the most expeditious approach. In Ethiopia, UNIDO just finished a project where the government wanted to take up pencil making. They have wood species that are quite different. Instead of putting a pilot plant in Ethiopia to evaluate the wood species good for making pencils, under the guidance of our expert they sent sample wood shipments to Germany where they were evaluated and out of the five species, within two months two were identified and the pencils actually made under production conditions. This is another approach that should be taken into account, i.e., you don't always have to always build a pilot plant to see the alternative which might be best.

The situation in the pulp and paper industry is similar. The backstopping officer for these type of projects described a pilot plant in gas utilisation erected in Cuba. Their guideline was that the country needs about 30,000 to 40,000 tons of paper for about 5,000 to 10,000 tons of newsprint which was imported. A pilot plant was designed to make the first 10,000 tons of newsprint for the country. At the same time, the size of the pilot plant was chosen to train up to 50 engineers and technicians per year because once oil is found and the gas is not used anymore in the sugar plants as fuel, Cuba has a potential of producing seven million tons of pulp and paper. This is really long-term planning. It's good even for a PhD now and then to go to a paper plant and remember how to change the 105 parameters on the paper machine and remember that there is a lot of practical know-how you can collect only, at least in the pulp and paper field, by having a little pilot plant. In Burma, UNIDO is also assisting in starting up a pilot plant this year which will handle only four tons a day. In many developing countries, the first five or ten thousand tons of your new product are produced in these demonstration pilot plants and then you build a plant. In Burma we designed it to get back some of the money for the pilot plant by producing something for the local market. We want to use the local students in the mechanical and electrical engineering faculty in order to produce something worthwhile for the country. In many of these IRSIs, we should use the facilities and be ashamed, e.g., to produce about 50 kilograms of glue for the local very small plywood industry as we do in Burma. They also produce 2,000 bottles of soft drinks in another research department of the central research organisation. This is doing something good for the local market because it is the only good drink in the country. That's one way of keeping your personnel, making them happy, making them proud of their contributions, and sooner or later the industry will join in, because as you train the people you get good contacts, more friendships and in the long run, of course, more money by having them on the Board and urging the government to give money to these institutions.

The speaker made one impassioned plea. His contacts with five pulp and paper institutions in Asia and Cuba have shown at least four or five areas where UNIDO/UNDP should continue to help these institutions. Usually, there is no foreign exchange, for instance, to buy technical literature. They don't get dollars, so this is one area where at least we could help to support these institutions by helping them to get their literature. The same is true for spare parts. In one pulp and paper

institution in India, 80% of the equipment was completely rotten and not being serviced at all because Sweden had ended its assistance. The UNDP/UNIDO should also encourage these people to publish their local scientific work. For instance, in Burma there is an IRSI which has worked for 15 years on bamboo, pulp and paper making. All the publications are in Burmese language. We offered money to the government to translate and publish five or ten of them in the international press, but the government doesn't want anything published, nevermind anything in pulp and paper. This is a real pity because the IRSIs must get a reputation and in some fields, especially in pulp and paper, they have excellent local expertise. Burma knows all about bamboo pulping, Philippines knows all about abaca pulping, Indonesia knows a lot about mango pulping, but the staff can't publish, can't make the world aware of this knowledge.

The staff member complained that he can't even help create partnerships or linkages, because the next problem is if somebody in these institutions wants to write a letter, it has to go to the Ministry for signature. That means usually you'll never get an answer, or it takes you six to nine months before somebody gets something done. Therefore, the speaker recommends having a stand-by fund to support these institutions which UNDP and UNIDO have helped establish and encouraged with such great hopes. He should not let them down, we should have extra money for spare parts. We should have extra money for publishing, to bring them out of their countries, and to create meetings so that they don't duplicate research work. This was one thing evident when five of these pulp and paper research heads in Asia were invited to the Appropriate Technology meeting in New Delhi. They met for the first time in their life. They didn't know anything about what was going on in these five different institutions. Many of their efforts were just duplication. UNIDO/UNDP has a real task to fulfill to go on supporting these IRSIs to do a better job in general.

The UNDP study co-ordinator stated that it was quite obvious that at the start of the discussion not everybody was using the same basic technical definition of pilot plant. After the extensive discussion on pilot plants, he detected agreement on the use of the term and when and how such plants are to be used. Despite the clarity and the unanimous approach and views expressed about pilot plants at this workshop, we still keep making the same old mistakes. He was recently in Syria visiting the Industrial R+D Center which can hardly do any basic testing work. Nevertheless, UNDP and UNIDO are involved in supplying a general purpose pilot plant with an expert and expenditures in the hundreds of thousands of dollars. We are setting up a pilot plant against the total wisdom of all of us in this room, and it keeps on going. He asks, when, where and who is going to bring a clarity of our technical expressions to governments and tell them no you should not do this? No, you shall not have the money for that because it's really silly?

Turning to another topic, but again within the context of the definition of IRSIs used in the evaluation study, i.e., multi-functional IRSIs which have a major research and development component, he noticed in the general discussion that some of the views expressed emanate from a political/administrative point of view which is necessary and obviously is an input to the discussion. Sometimes the comments are being offered

from an economic point of view, which is also very relevant. And sometimes, they are being made from a scientific-technical or engineering point of view. Because of the background of those present, he would have expected that most of the discussion would be at the technical-scientific-engineering level. When touching upon this general subject matter, the issue that confronts us is should developing countries do research or not? In fact, that is a political question, and this group is not here to give an answer to that question. The evaluation study did not try to give an answer to that question. What we're trying to really address ourselves to is the technical-engineering consideration, i.e., whether an IRSI can carry out oriented research. In other words, whether an institution and a group of technical and scientific people can be told this is the problem, devote yourself to this problem and get us an answer. The experience of UNDP/UNIDO in the past is that we have been generally assisting IRSIs which have been doing R+D in the abstract, which is necessary and essential for it to occur. But what we are asking ourselves, frankly, is should UNDP and UNIDO, with the limited funds and resources available, continue to dedicate itself to supporting this general R+D function or should we concentrate in assisting development-oriented R+D which will have a payout? This is really the fundamental question, in his view, and what we are addressing in the IRSI study. Is it possible to do oriented R+D? When we speak of oriented R+D, it immediately brings to the fore the linkages that we all have been speaking of in the sense of who is to participate, who is to use it, who is to ask really for this oriented R+D?

Again, to clarify terms and to assure a common understanding, a previous speaker referred to UNIDO's evaluation unit saying this, that and the other. In all fairness, the evaluation unit of UNIDO is not saying anything. The IRSI study is not an expression of an evaluation unit. It is an expression, as UNIDO's Senior Evaluation Officer very correctly put it, of a lot of technical and scientific people who participated in it, both from UNIDO, from the very few that we have in UNDP, and from consultants who deal closely with the subject matter. It's not so much of a question of contesting what an evaluation unit is saying, rather it is a question what we as professionals in the field are saying to ourselves and he hoped that the report would be read and viewed in that fashion. In other words, what do we have to say about IRSIs substantively?

The Head of the Development and Transfer of Technology Section commented on the pervasiveness of the problem of how IRSIs can establish effective linkages with the industry they are intended to serve so that they can really contribute. TEC has undertaken a pilot operation aimed at finding a practical approach to getting IRSIs involved and focussed on real problems. The operation is essentially a systematic networking of IRSIs. It is essentially designed to provide services to the small and medium-scale industries in the rural areas by establishing contacts with them and feeding this information back to the IRSIs and also getting them to provide services as and when needed. The project started by making a survey of existing institutions in the Philippines, their capacities, their capabilities, what are they doing, and so on. Another survey of small and medium-scale industries in the rural areas was also carried out on their needs and requirements. These two surveys were performed within the three sectors of woodworking, food processing, and metal working. The Government already had a national

programme for servicing a small-scale industry and there was a skeleton or framework of activities through the Commission for Small and Medium Industries (CSMI) under the Ministry of Industry. CSMI has 11 regional offices which were supposed to be contacting the small industries within their territories to identify their needs, requirements, and to provide the necessary advice. The skeleton was there but the blood was not yet flowing through the pipeline, and UNIDO proposed to tie in the available IRSIs and get them involved. This was accepted and they were referred to as the technological participating agencies. The field staff, as often as possible with staff of the CSMI in Manila and, if needed, with a representative of the Technology Participating Agency, visits the industries on a scheduled basis to identify the technological problem. These problems are fed back to the appropriate IRSI who then include them in their work programme. The solutions are either to look for information, gather up expertise, etc., and if this was not available, then they refer it to multi-lateral or bi-lateral agencies for inputs through international experts and consultants. These inputs are provided in a manner of "on-the-job" training, in other words, the expert goes with the staff of CSMI and the technical assistance inputs do not go down the drain, but remain in the Philippines.

The project was initiated about two and a half years ago and already a number of shortcomings have been identified, for instance, the need of training at all levels, an information system that is the accumulation of information on problems already solved, and information on new technologies, management, etc. The advantage of this system is that there is daily contact with the small and medium scale industries, which are also the clients, the potential customers of the IRSIs, and by identifying the problems and feeding them back to the institutions, it helps in orienting the IRSI work programme towards the problems which the country is facing be it research and development, extension services, or whatever. In this way, it contributes to the strengthening of the indigenous technological capacity and capabilities to serve the needs of the country. This significance has been recognized by the government which has now incorporated the concept into the national development programme and has allocated national funds to support the TSDS system. It is hoped that within the next few years it can be completely transferred into a national programme. There is also consideration being given to expanding the TSDS to a sub-regional or regional level - as a first start perhaps, to focus on the ESCAP region - to create centers of excellence in the various industrial branches common to each country with a networking mechanism to support each other's needs and requirements. Eventually it is hoped to expand the network to other regions and, hopefully, this will qualify for funding by the Interim Fund for Science and Technology Development.

A staff member from PDES commented on the points previously made about adapting IRSIs to the characteristics of an existing industry. We all know the existing industries in most developing countries are of the small to medium-scale type. Therefore the Indonesian examples given by the SIDFA and the Technological Service Delivery System being applied in the Philippines, are examples of modest but practical approaches to the utilisation of services being provided by IRSIs. He suggested that staff members need to approach the problem more from the ground up

and in a more modest scale, making use of existing bodies while strengthening them at the same time by exposure to actual problems. The UN system must find a way of influencing governments to attempt things on a less ambitious scale and making use of already existing institutions.

A staff member of ICIS, who participated in the evaluation study, commented on the statement that the needs of industry should be the starting point and that the initiative for IRSI services or products should come from industry itself. This is right, but perhaps it's not the full picture. The IRSI also has a role to fulfill in being ahead of industry, in being an instrument for government policy makers and planners, to look into various possibilities such as the utilisation of local material and so on, and that governments, in certain instances, should also be clients to IRSIs. Certainly, it should be on some sort of contract basis working on definite tasks. This leads to the importance of a well-conceived mission-oriented research programme for the institute. However, R+D is only one part of an IRSI's functions and the direct service function, i.e., testing and so on, may be more important in the beginning. With maturity comes the problem-solving function for industry and finally R+D, usually ahead of the industry and responding to the opportunities and the country's development needs. This should be done on a very programmed basis as a contractor to government clients and other organisations. Referring to the need for cooperation between institutes in the same branch in different countries in the region, the speaker cited the regional network for agricultural machinery as a very good example where the branch or type of industry has a country dimension, the conditions are different in different countries and it's normally producing for the local market, but at the same time, there's lots of possibilities for exchange of experiences and work. He suggested this as a very practical approach with mutual benefits for the countries involved.

The next speaker, the principal consultant for the joint exercise, did not believe that the workshop should end up with a general conclusion that IRSIs have been failures and this was not the intent. There are a number of IRSIs in developing countries who have been successful within the terms of the environment and the local conditions under which they work. Some of these have been in existence for 20 years. A number of institutes with which he is personally acquainted derive 70% of their annual operating income from services outside of their government subsidies. An IRSI cannot survive for 20 years in the absence of a total and complete government subsidy unless it has been providing a useful service for someone; viz. industry to the extent it was possible, government, international organisations, etc. Of course, these IRSIs have had problems and all of them have shortcomings as does his own former institute. It would have been very interesting to look further at the successful operations of these IRSIs within the context of the total evaluation but unfortunately there were neither funds or time available for this kind of an analysis and some choices had to be made. A lot of experiences have evolved over the years on how IRSIs, such as the Regional Institute for Central America, the Technological Institute in Colombia, the Singapore Institute of Standards, and KIST in Korea, on which how IRSIs can operate successfully. Thus people have developed a certain expertise over the years that should be transferable into

utilisation by IRSIs in lesser-developed countries. Most of these IRSIs have economists or economists/engineers on their staffs. They have linkages with other institutions, both within their own countries but more often outside. They have mechanisms for obtaining support from international and bi-lateral organisations. They also have ideas about which they want to pursue. They do very little if any basic research but they may do long-term applied research.

A good example is the Institute in Colombia which started 10 years ago to establish a capability in coal processing. At that time, Colombia had plenty of petroleum and saw no need for coal in the near term. At the present time, Colombia faces a crisis in terms of the need to expand its energy resources and they are looking desperately for ways to utilise coal. IIT in Bogota has this expertise because they started a strategic programme 10 years ago to develop this capability. These IRSIs are not failures. What we are looking at is the problems that they have had as they struggled for maturity and viability to see if we can assist other IRSIs in resolving common problems and improving their performance and relevance.

A former IOD Deputy Director and ILO staff member noted that the experience ILO has had with their productivity institutes is similar to what UNIDO is experiencing with its IRSIs. The workshop had identified many reasons why IRSIs have not always been successful, among them that the directors and staff are not necessarily the right people. Having participated personally in the exercise and studied most of the reports, he noted that the IRSI directors were either civil servants or university professors, but hardly any come from industry. In the eight productivity centers the speaker worked with all over the world, hardly anybody came from industry. This relates to the question of how much the staff is being paid. Clearly they have not been paid enough. He cited an example in Egypt many years ago where ILO worked with a productivity center. Officially it was very successful but they couldn't get the staff to stay on. The staff started their own productivity center, paid themselves higher salaries and took fees from industry for their services. It was flourishing within a short period of time. Similar examples can be cited with IRSIs. When in Trinidad two years ago to look at a very successfully initiated institute, it took only limited funds for their services and were experiencing a number of problems discussed in this meeting. Two kilometers away was another UNIDO project, a methods institute, which from the beginning charged fees for its services and they were flourishing with the best engineers in Trinidad and few problems. It can be concluded that industry evidently goes to quality institutions even if it has to pay for the services and giving services free is not necessarily the best for an IRSI's future. Perhaps UNIDO should consider the sociological and economic aspects which are very important for the kind of personnel and participation necessary for success.

A clarification was offered on the possible IRSI function in the subject of purchasing "know-how". In many cases the IRSI is not involved in the very vital process of selecting the best know-how that is available abroad. These are functions handled by the finance ministry or by the central bank but it's a technological problem in which the IRSI staff should be consulted - not in a sort of a pro-forma or routine manner - but is highly involved first in knowing what is available within

the country and then supplementing it in a very selective manner. This is not being done in most cases.

Regarding pilot plants, a New York staff member mentioned that the General Assembly Resolution which set up the UN Interim Fund on Science and Technology Development specifies that it is to provide technical and capital assistance. Capital assistance is being interpreted as meaning basically the mechanisms or investments needed to translate research results up to the semi-commercial enterprise scale. It means the whole spectrum of activities, including pilot plants, and this element of capital assistance should be kept in mind when formulating projects for the Interim Fund. There seems to be a consensus that if it's a single process pilot plant, this is best done outside the IRSI in close cooperation with the potential buyers of this technology. The speaker started his career 30 years ago with the US Bureau of Mines in operating a pilot plant to produce sponge titanium by the chrome process. The Bureau of Mines put up 50% of the cost and two or three American companies, including National Lead, participated in the other 50%. The plant was an open house where all companies which wanted this know-how could observe the operation. It was highly successful and it led to the titanium revolution. On the other hand, if there is a general-purpose pilot plant, such as in the minerals beneficiation business where you may have certain unit processes, crushing, grinding, flotation, roasting, etc., in one kind of a flow sheet but with the high flexibility to be able to change that flow sheet back and forth in order to try out or scale-up certain processes, this is not a pilot plant in a very specific sense. It's really a larger scale of laboratory equipment and certainly the IRSI could well have a pilot plant of that sort.

The one mechanism that does not seem to have been sufficiently discussed is the kind of institution that originated in the United Kingdom after the war and was then adopted in India, in Japan and various other places...the so-called national research development corporation. Here is an institution, generally government, which holds all the patents of the complex of research laboratories within a country and has the responsibility to sell its research results, to invest in pilot plants and to attract venture capital. In Korea there is the famous unit called KTAC, the Korea Technology Applications Corporation, which holds all the patents of KIST. KIST does not go into the commercialisation business. It is not equipped to do so. But KTAC buys the patents, sells them, and part of the profits that are produced using those processes in the plants are plowed back to KIST. There are a large number of mechanisms for translating research results into commercial operations scale and the speaker concluded that this is obviously an area where UNDP/UNIDO should be more active.

Referring to the theme introduction, a consultant commented on the recommendation of Dr. Cordua that IRSIs should have some sort of sales office or sales unit which can sell institute services. The speaker's experience has been rather negative in this respect but he agreed that perhaps Cordua is right. If you sell very sophisticated services you have to have sophisticated people to sell them and that means it could only be the institute experts themselves. But if you

have a clientele which is more or less uniform, they may be all related to agriculture or mechanical industry or something like that, and the services you want to sell are fairly simple, then the sales people could talk sensibly about it and it might work. The point is that whether or not you can have a central sales organisation probably depends a good deal upon the market and nature of the institute.

In replying, Cordua suggested that you need to have inside the IRSI the same sort of relationship that is so successful in research and development groups in multi-national corporations or in large state corporations. There you have daily contact between people who are responsible for production, people who are responsible for commercialisation, and people who are involved in research and development. In most IRSIs in developing countries, you have no such relationship. When you have two such departments, a department for making the more specialised technical work and a department with a larger perspective including economic and other aspects, then in the interaction of these two an IRSI becomes much more realistic.

The UNDP study coordinator noted that a previous speaker with experience with textile centers suggested that IRSIs should be industry supported and pointed out that many of the problems observed with IRSIs arise from the fact that they are getting government support. General government support brings with it a system of operations which gives to the IRSIs not only the financial backing that is desirable but, on the minus side, it also brings many of the problems that have been analyzed and discussed in this workshop. There is common agreement that IRSIs have to be closely linked to service with industry, to have a rapport with industry, to understand industry, to communicate with industry. Yet, we find that this is not so. He wondered whether one of the conclusions to come out of these discussions, or tentative agreement, is that maybe one doesn't need government to have a successful IRSI.

The Head of UNIDO's Factory Establishment and Management Section said he interpreted the major conclusion to be that R-D, as a principal IRSI function, is appropriate only in the more developed countries but that the service functions to industry are a very much expected part of IRSIs everywhere, even in the industrialized countries. One of the principal problems appears to be that there is no contact, or not enough contact, between industry and the IRSI. The consultant went into detail how they solved it in some places and, recalling some of the old project documents he was familiar with, he admitted that the part which should define how these IRSIs will serve industry was extremely vague. There is usually a sentence that the experts will go out and visit the industry, see what the problems are, write a report and that was about it. He hopes that in the future this part of the project documents will be spelled out in detail, particularly how the IRSI will function because this is the key to their success. Regarding the conclusions to be drawn from these meetings, he suggested that it might be one of the most valuable future activities of UNDP and UNIDO to go back to some of these IRSIs and help them establish some critical functions which we have omitted, unwillingly or not recognizing its significance in the past. This would be an optimum utilisation of investments already made by helping them function in the way it was originally intended, whether it be in the form of establishing an internal management group, a systematic institutional basis as described by Mr. Tanaka, or on the basis of

Dr. Cordua's marketing concept. It might be worthwhile to go back, country by country, institute by institute, to define where this industry-IRSI compact does not exist or is too weak, go back there and try to give them the help. It could be done with relatively little money, and improve the returns on the investments already made by the UN system and the IRSI sponsors.

Another Section Head asked: how do we respond to the question of whether we need government or not? Do we have to approach multi-branch type of institutes or also other types? He believes there is no one generally accepted response to these questions because the IRSI, in spite of the main line of these discussions, is a wide variety of forms, tasks, requirements and local political, economic and environmental conditions. The approach to the problems of individual IRSIs should be selective and individual, taking into consideration all the relevant conditions and circumstances. We can find no recipe which will be applicable to all kinds of IRSIs, both those here discussed and those which were not discussed, or to all kinds of countries and governments.

IV. Concluding Remarks

The chairman observed that the workshop had provided the occasion for a wide-ranging discussion, covering many topics and issues. While not in a position to sum up these very useful discussions, based on the wealth of experiences of the participants gathered here, he did address some of the points raised which he thought were very important. One is the question of institutional coordination, i.e., that IRSIs, and as a matter of fact any institution, must take into account all related industrial institutions if it is to become effective. This is a major point which has to be kept in one's mind when developing technical assistance projects in these areas because one tends to create new institutions without the relationships being clearly defined. The institutional framework has to be examined carefully in regard to setting up new IRSIs.

Also touched upon was the various transfer mechanisms such as the TSDS experiment in the Philippines. These are very important, particularly when it comes to small scale industries. The relationship between the activities of IRSIs and of industrial development centers is also important because this is the area where the choice of technology is determined. In the case of technology choice there have been a number of interventions emphasizing the fact that one of the main activities of IRSIs should be in assisting government and orienting new industries on the basis of labor-intensive technologies. This can only be done in certain cases through experimentation on the combination of capital with labor, which brings us to the question of the pros and cons of pilot plants which have been given a great deal of prominence here. There are cases where such pilot plants should be undertaken only in cooperation with a technical (industrial) partner, particularly in large-scale industries. Nevertheless, there are also areas, and perhaps this applies mostly to the lesser developed countries, where small-scale and agro-industries need to be given some kind of priority, wherein one has to conduct some kind of controlled experiments with IRSIs in order to be able to introduce either new technologies or to utilise existing resources more efficiently. He believes the consensus on pilot plants has not been to reject the concept but to use them in a contemplative and appropriate manner.

As far as linkages are concerned, of course the most important linkage for an IRSI is the industry sector, but there is also a role for government; government in the sense that an IRSI can be effective in achieving economic objectives only if it understands and correctly interprets government policies. That is not entering into the area of politics. It's a matter of looking at the policy of government and responding to its priorities. This is where a multi-disciplinary approach is important in the setting up and operation of IRSIs. Citing an example on the role of government, the chairman had just returned from a mission to Zimbabwe, formerly Southern Rhodesia where the industry sector is the most important, contributing 26% of the GDP and is the main earner of foreign exchange. It's a highly sophisticated industry sector but there is no single industrial research organisation. This has so far been carried out by the industry itself, the multi-national corporations are there and they utilise their back home research and development facilities. Insofar as the needs of small-scale industries are concerned, their next door neighbor South Africa could provide results of research and development so they did not find it necessary to set up industrial research institutions, in contrast to a very advanced set of institutions for the agriculture sector. The new government realises that it has a different development objective from that of the past government. It wants to stress other priorities and therefore the existing set up is not adequate, does not fulfill the requirements of the new government. For that reason the government intends to set up industrial research organisations which would serve the purposes of its new policy objectives. Unless government gives such guidance, the establishment of IRSIs on their own might not fulfill national objectives.

As far as future UNDP/UNIDO assistance is concerned, and particularly the Programme Advisory Note that is being prepared, there has been a lot said here from which we can draw. One concerns the unhappy experiences of IRSIs which did not succeed but, at the same time, there have been successful IRSIs and we should also draw from their experience. On that basis, perhaps a new thrust, a new scope for UNDP/UNIDO assistance could be drawn up.

