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PROVIDING RELEVANT EXTENSION SERVICES TO INDUSTRY *

prepared for the

Joint UNDP/UNIDO Evaluation Study
of Industrial Research and Service Institutes

by
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I. INTRODUCTION

One of the weaknesses of IRSI's in developing countries is the lack of effective and appropriate industrial liaison and technical extension activities. If, indeed, the IRSI is serious about interaction with the industrial sector, it should be obvious that IRSI staff cannot develop such interaction only through publication of reports and in the isolation of their laboratories. It is also clear that not all scientists and engineers are interested in or capable of developing good industrial contacts or promoting their institute's capabilities. At the same time, particularly in some civil service type institutes, the table of organization makes no provision for such industrial liaison, expertise, and institutes dependent on major funding from external sources have been reluctant to assume, as an overhead item, the costs incurred from such activities.

In the face of the oft-stated lack of confidence by industry in the IRSI, it seems obvious that such lack of confidence could be overcome to an appreciable extent if IRSI staff (or preferably IRSI technical extension representatives) were to dedicate a certain portion of their time and energies to plant visitations. In the course of this process, the IRSI staff would be able to learn at first hand the realities of production, to identify potential areas of research, alternative technology application, or other service problems, and would be in a good position to promote their IRSI's capabilities. It is clear that aggressive salesmanship is required, backed by effective laboratory services, if an IRSI is to improve its relationships with industry. It is likely that initial technical extension assistance will be limited, at first, to provision of know-how information or to make the industry aware that analysis, testing, and quality control services are available through the IRSI. A practically oriented, alert observer, however, may be able to identify a real problem which often exists beneath the surface symptoms recognized by the industrialist and point this out to him, thus again leading to an opportunity for the IRSI to provide technical services.

Often, an inexperienced technical extension agent, on being told that industry does not have a problem, will cross that industry off his list and not make a return visit. Repeated contacts are necessary, particularly in early stages of technical extension activities and in industrial liaison, if the industry is to become convinced of the potentiality of technical services.

It seems that small- and medium-scale industries hold the greatest potential for requiring technical extension assistance, but usually these do not have the ability to pay for such services. Such industries suffer not only from lack of technical assistance but also lack of management and financial assistance. Usually, these industries are unable to recognize the nature and extent of their problems. Nonetheless, if developing country governments are serious about strengthening and expanding their indigenous industrial base, concerted effort must be directed toward providing suitable financial mechanisms to undergird technical extension assistance. IRSI's, however, should not limit technical extension activities to small-and medium-size industries, but should recognize the potential for large industries as well through appropriate industrial liaison.

When IRSI's can find no other mechanisms for funding or forming a technical assistance function, it is often possible to establish collaborative agreements with national productivity centers who deal frequently with small-scale industry. In this manner, the IRSI capability to provide service can be expanded, and IRSI knowledge of appropriate technology or adaptation of technology can be transmitted to the end-user through the staff of the productivity center. While it may be seen that this is not necessarily the best arrangement, it does provide a mechanism for service by the IRSI to industry. Unless an IRSI can obtain qualified technical extension staff, the mechanism may prove to be more effective.

It is important to note here that full collaboration and cooperation must take place between the in-house research staff and the technical extension agents. The technical extension agent must understand fully the capabilities, functional activities, and work schedules of the IRSI, otherwise, during the course of industrial contacts, he may promise

solutions or services which are difficult or impossible for the IRSI to provide. Similarly, if the problems, research or services requirements brought home by the technical extension agent are ignored or given a low priority, the confidence developed by the technical extension agent in a particular industry will be shattered. If the IRSI cannot solve the problem or provide the services requested, no matter what the reason, the technical extension agent should be prepared to indicate, to the industrialists, alternative solutions or alternative organizations which may solve the problem. Even though such an approach may not directly benefit the IRSI, good-will and realization of the IRSI's professional approach to the situation will, in the long term, have a positive impact on IRSI-industry inter-relationships.

It should be understood, the provision of effective technical activities will not resolve all the difficulties of IRSI-industry interaction. Technical extension should be considered as only one, albeit an important one, of the total functional activities of an IRSI. Outstanding technical liaison on the part of the technical extension agent will be fruitless if the IRSI is unable or unwilling to provide equally effective technical assistance. Thus, it is incumbent on IRSI senior management to monitor carefully the inter-relationships between technical extension agents and the in-house research staff.

If the above conditions are met, however, it is reasonable to assume that the presence of technical extension agents, as part of the functional activity of the IRSI, will greatly enhance the contributions of the IRSI to national industrial development goals and thus to improvement in national economic growth.

II. FUNCTIONS OF A TECHNICAL EXTENSION ACTIVITY

The question is--how can IRSI's assist industry, either to survive or, perhaps more importantly, to become more effective, to grow, to hire more employees, to contribute to the national economic growth and development? Some IRSI's have devised an approach similar to that of an agricultural extension agent. Technical extension experts, usually engineers with

industrial experience, call regularly on industry, sometimes solving their management-technical problems on the spot if possible, referring more complicated problems to the IRSI laboratories, and advising development banks on similar entities of fiscal problems. Thus, technical extension agents have, in reality, two purposes: (1) to provide effective assistance to industry; and (2) to serve as a vehicle for IRSI promotion and project development. Usually, services of this nature are not reimbursed, thus the IRSI requires funds for such purposes, either from the government or bilateral or international funding support.

A. Components of a Technical Extension System

If relevant technical extension services are to be provided by the IRSI, several system components are essential in addition to the technical extension agent and become a part of the technical extension agent's portfolio of services to be offered to the industrial client. The system should have two major objectives. The first is to provide needed technological services to industry (and to government in many instances); the second is to feed back information about the needs of industry to the IRSI and other related institutions or to government entities which are concerned with the generation or adaptation of new technology. That is, R&D priorities in the IRSI and research and development planning in the government ministries should be strongly influenced by the kind of information that is fed back from the clients or contacts of the system.

While the development and implementation of a technical extension system to provide assistance to local industry, particularly small-scale industry, should be tailored to fit the specific circumstances and local conditions of the country, such systems could provide services of the following kinds:

- o Identification of industry needs which have a technological component;
- o Development of technical and/or performance specifications required for technological acquisitions;
- o Identification of alternative sources of technologies;

- o Performance of technical validation and evaluation of technologies;
- o Performance of technological adaptations;
- o Assistance in technological installation, start-ups, and repair and maintenance;
- o Assistance in negotiations with technological suppliers, financing sources, government agencies, etc; and
- o Performance of technoeconomic feasibility and marketing studies, etc.

Once the system is established and functioning, the system can acquire a wealth of information regarding the application and need for industrial research and services. The information can be categorized by (but is not necessarily restricted to) the following:

1. The collation of technological information including patents. In order to be able to select and adapt the most appropriate technologies to be utilized under certain local conditions, entrepreneurs must first know what alternative technologies are available. They must also have this information in a format which facilitates the making of decisions and choosing among them--e.g., costs, properties, terms of payment, guarantees, etc. These data should be readily comparable.
2. A cognition of the size distribution of production units and of the utilization of capacity for these units. It is noted here that large-scale production tends to favor transfer of technology via importation and adoption of foreign technology, whereas small-scale production tends to require the development of indigenous technology. Also, knowledge of capacity utilization rates, together with an appraisal of missing links in the industrial sector, often indicate possible problem areas and, hence, a need for industrial research.
3. Information regarding existing internal trade routes, external trade relationships and the geographical identification of major markets. This information facilitates the identification of the level of economic activity, the actual or potential shortages of

particular goods and services, and, hence, the long-term needs for industrial research.

4. Cognition and impact of the country's industrial policy as well as industrial practices. Governmental industrial policy can have a significant influence upon the potential success of industrial research, because it may favor labor-intensive production techniques, import substitution, or other desirable objectives which create the need for research. The significance of government industrial policy may be exemplified by established long-term arrangements with overseas markets for the supply of raw materials and semi-finished products.
5. Information concerning international and national sources of finance as potential support for entrepreneurs who may be interested in implementing technology which is identified as appropriate and available to the country. These sources of finance will include, but are not necessarily restricted to, the Inter-American Development Bank, the IBRD, the Asian Development Bank, as well as the national development and commercial banks.

It is recognized that the development and implementation of a technical extension system is of the utmost importance if appropriate technologies are to be introduced on a larger scale than has been the case thus far. In its most useful interpretation, appropriate technologies mean that the more scarce resources must be conserved and utilized only in key technologies or where no other alternative is available, while the relatively abundant resources must be utilized as intensively as possible. The selection of appropriate technologies can be significantly strengthened via the introduction of a technical extension system, which will minimize both the direct and social costs of the further development of the country's industrial progress.

What, then, should be the IRSI provide as components for this system? These are:

- o Implementation-oriented information services, which provide practical answers to nuts-and-bolts questions in the form of semi-aggregated technical-economic-purchasing and other inputs to design engineers, managers, entrepreneurs, etc. This requires information on machinery or equipment specifications, design data for pilot plant construction, availability of components that might be locally assembled in a local production operation, etc. There is also a need for information about patents or processes, perhaps outmoded in a more advanced country but still appropriate for application in a developing country. Finally, information is frequently needed regarding the possibility of process scale-down through use of new equipment, design parameters, etc. While the IRSI may not have such information in its own library, recent development of a number of worldwide information systems, makes possible, through linkages with IRSI's or other organizations in advanced countries, acquisition of such required information rapidly and at the lowest possible cost.
- o Industry-oriented IRSI laboratory services, which, depending on the extent of need and level of industry sophistication, should be prepared to provide rapid response to requests for analyses and testing, quality control, applied R&D in utilization of natural resources, process and/or product development, adaptation and/or modification of technology, and demonstration or pilot plant operations. It is important to emphasize here that such services must be oriented to rapid response, attuned to the needs of the industry, and prioritized so that incoming requests from the technical assistance agent will be promptly complied with. While such industrial services will undoubtedly interfere with the desires of the IRSI research and technical staff to conduct programs of a longer term (and probably relevant only to the future), the prime responsibility of IRSI management, if it is genuinely interested in industry interaction, must be to assure that industry requests for assistance are satisfied promptly.

- o Industrial liaison units, which include the technical extension agents, should be organized by the IRSI's (either through organizational change, or through matrix-type utilization of existing capabilities in several research and service divisions of the IRSI) to do the following:
 - a. Investigate and point out the problems that need further studies, in the sector concerned;
 - b. More clearly formulate the problems, with persons or firms concerned;
 - c. Find or help find solutions to problems;
 - d. Communicate the results to persons or firms involved in a way that can be understood and applied by the latter.
 - e. Followup and evaluate the effectiveness of services given and determine the extent to which the results have been useful.

The importance of industrial liaison units cannot be over-emphasized. Such units can materially assist the IRSI to gain awareness of industry problems, to gather information about industry needs and to gain experience by the IRSI in industrial problem-solving. Industrial liaison units have the potential to conduct industry sector surveys, initially to formulate IRSI objectives and functions, or to suggest change in IRSI functions to meet changing need. Such surveys also assist the IRSI in keeping abreast of changes due to national economic growth and changes in the national planning process, and can guide IRSI planning to anticipate future IRSI direction.

B. The Technical Extension Agent

If the above IRSI services are available and functioning effectively, the technical extension agent can be an important contributor to IRSI growth, relevance to national needs, and interaction with industry. In the absence

of such supporting services, it is highly likely that the technical extension agent will be ineffectual. As discussed earlier, no matter how many industry contacts and potential industry service needs are developed by the extension agent, if back-stopping and rapid response to the requests for assistance are not forthcoming, the technical extension agent will be unable to perform effectively. Unless IRSI management is committed fully to support of a technical extension agent, and prepared to undergird his efforts in a meaningful way, it will be impossible for the technical extension agent to achieve more than minimal interaction between the IRSI and industry.

On the other hand, with full IRSI support and cooperation, the technical extension agent has the potential to develop new projects for the IRSI, to improve the IRSI-industry relationship and assist the IRSI in making major (instead of minimal) contributions to national economic growth and industrial development.

The technical extension agent, with responsibility mandated for frequent and continuous contacts with industry, can, if well trained, experienced, and back-stopped by his IRSI, perform the following functions:

- o On-the-spot problem-solving, which may be management or technical in nature. Often, particularly for a small industry, the problem of the industry can be resolved by improvements in material flow through the process, by suggested changes in the process which improve employee efficiency (e.g., process lay-out which results in excessive handling of process components, poor product line design which wastes time or results in lack of optimum product component flow, etc.), or by suggested changes in equipment operation and productivity;
- o Identify industry problems solvable by the IRSI, whether these require analysis of raw materials to gain an insight into the process itself or to optimize the process, testing and/or quality control of intermediate components as well as the final product, or applied R&D directed towards process or product improvement, substitution of alternative raw materials, modification or adaptation of alternative technologies, etc.;

- o Refer technical information needs to the IRSI, in terms of design data, machinery and equipment specifications, new process and product information, alternative available technologies, etc;
- o Serve as "translator" between IRSI results and industry utilization. Frequently, laboratory technical results and reports are incomprehensible to the industrialist, particularly if he has little or no scientific background. The industrialist wants the answers and solutions to his problem to be explained in a manner which he can understand and apply, rather than in terms of formulas, equations, or tables and charts of data which may have no meaning to him;
- o Refer industry to alternative assistance. If the IRSI is unable to respond to certain specific assistance needs (due to lack of staff experience, equipment requirements, etc.) the technical extension agent should be prepared to recommend alternative sources for the required services. These might include private consulting firms, standards laboratories, or other IRSI's in the region. While the parent IRSI would not, in such instances, benefit directly, the good will emanating from such references to alternative sources of assistance will have a positive impact;
- o Assist in the promotion of the IRSI and awareness by industry of IRSI capabilities. To communicate is the beginning of understanding. The technical extension agent, in frequent contact with industry, can serve an important function as "broker" between the IRSI and industry. Through the mechanism of a two-way exchange of information about industry needs and IRSI capabilities (communication) both IRSI and industry will begin to understand the need to work together. The IRSI is thus brought out of isolation and gains an insight into the nature of industrial problems. Industry which, under other circumstances, may not even be aware of the existence of the IRSI, can learn to recognize the potential which exists for technical assistance and services. It should be obvious that a technical extension agent performing this function on a frequent basis will have an excellent opportunity to promote IRSI research efforts which have a potential for commercialization, but which

have not been recognized for exploitation by entrepreneurs, who usually are not aware of the IRSI's research activities;

- o Follow-up on all IRSI-industry interactions to assure that industry is satisfied with results provided by the IRSI, has been able to utilize and/or apply the results satisfactorily, and that the problem has been or is being solved. All too often, technical staff tend to believe that, once a report is prepared, there are no further steps necessary. But, if the research or service results are not implemented, then the IRSI effort may be meaningless. The technical extension agent, through his frequent contacts with industry, has an excellent opportunity for follow-up to assure that the IRSI provided what was needed and that industry benefited from the results.

It should be obvious that, in all of the above, effective control measures are mandatory. Requests for information assistance must be detailed in such a way that the IRSI technical information unit, without the opportunity to talk directly with the requestor, will be able to find the specific data or information required. Similarly, the exact nature of the analysis and testing to be undertaken, or research to be conducted, must be succinctly prescribed. Promotional efforts which require additional inputs by IRSI staff members must also be clearly defined. Finally, such control measures, if properly implemented, will provide IRSI management with a mechanism for evaluation of the technical extension function and an opportunity to modify or re-direct the service if necessary.

It is probably unnecessary to state that the best control measure is in the form of a technical extension agent daily contact report designed so as to provide all data necessary to the other units of IRSI.

C. Using Technical Assistance Agents From Other Organizations

If the IRSI can find no mechanism for employing technical extension agents, as a result of staff limitations, salary or other constraints, or unavailability of persons with industrial experience, it is still possible to establish a form of technical extension through cooperative agreements with

national productivity centers or similar organizations. Ususally, such organizations are funded directly by the government to devote their major efforts in providing assistance and training to small-scale industry, although seldom do they have the full range of information and laboratory services necessary to solve all of industry's problems. Thus, a merging of talents is seen as a viable alternative for the IRSI. The disadvantage, of course, is that IRSI management has no real control over such "external" agents, so that considerable additional effort is required to assure that the external agent is fully aware of the IRSI capabilities and that he feeds back requests at frequent intervals. In all probability, use of external agents will limit IRSI ability to cover all industrial sectors of interest to the IRSI, so that external agents should be considered only as an initial or stop-gap measure.

III. CONCLUSIONS

The technical extension agent can be a powerful force in increasing IRSI-industry interaction if both IRSI management and IRSI staff will recognize this potential, make full use of the agent's efforts and cooperate in providing rapid response to the industry requests provided through the agent. The need for an integrated technical extension system within the IRSI is clear. Industry-oriented information services and industry-oriented laboratory services are essential components of the system.

If management is indifferent and the research and services staff is unwilling to provide the services requested by the technical extension agent, then the system will fail. On the other hand, both management and research staff should be able to recognize the potential for identifying research and service opportunities which may be otherwise unknown to the IRSI.

To the extent possible, technical extension agents should be recruited from within the IRSI staff so that these agents will already be acquainted with the nature and capabilities of the IRSI. Even so, training in technical extension services is desirable, since most research staff members will

have little or no industrial experience or knowledge of liaison with industry. Such training is sometimes available through WAITRO (World Association of Industrial and Technological Research Organizations) or through the Canada Institute for Scientific and Technical Information. It is appropriate for UNIDO to consider establishment of a training program specifically directed to technical extension agents. Such training could utilize the experiences of a number of IRSI's around the world, including the Central American Research Institute for Industry (ICAITI) in Guatemala, the Singapore Institute of Standards and Industrial Research (SISIR), the Korea Institute for Science and Technology (KIST) and the Scientific and Technical Research Council of Turkey (TUBITAK).

In 1972, WAITRO conducted a survey of the priority needs of approximately 80 member institutes.* In the table following, it may be seen that IRSI management perceived, as highest priority, needs having to do with identification and understanding of industrial problems and the promotion and selling of technical services. While there was no specific question addressed to the need for technical extension services per se, it is clear that such services can perform an important role in connection with the highest priority needs as expressed by WAITRO members.

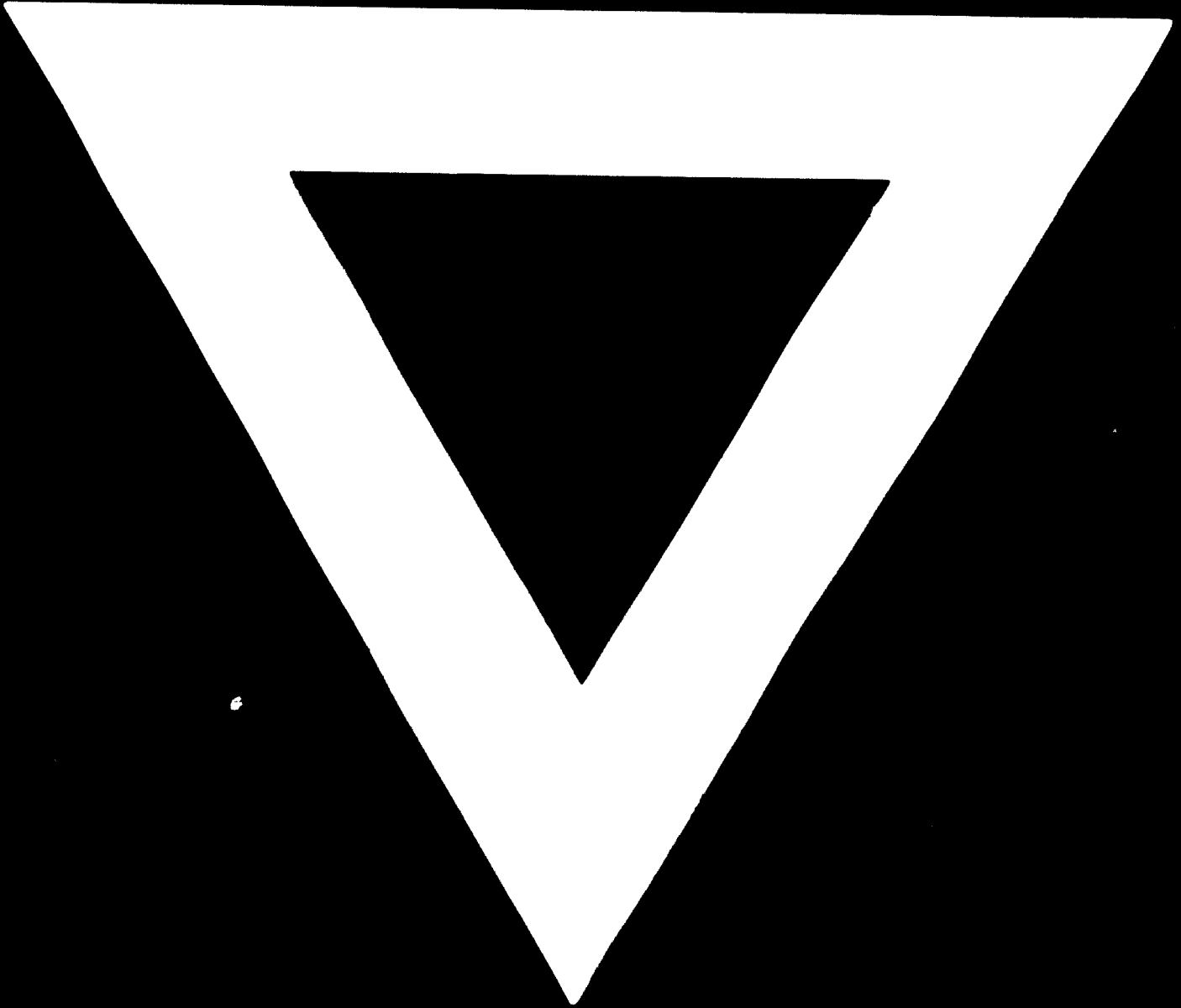
* Priority of Needs of Industrial Research Institutes in Developing Countries, Publication No. 3, World Association of Industrial and Technological Research Organizations, Vancouver, Canada, pp. 2-3, June 1972.

Priority Ratings on Industrial Research Institute Designated Needs

	Priority Rating	
	Relative Position	Relative Weighting, %
Industrial training of technical personnel Training in industrial application of R&D	1	100%
Industrial exploitation of R&D results	3	91
Financing of equipment Financing of training of personnel	4	89
Managerial training of personnel	6	86
Financing research projects Dissemination of technical "know-how"	7	84
Promoting research programs Sources of technical information Needs related to trouble-shooting	9	82
Training in promotion of technical services and research Financing travel to seminars, meetings, to other IRIs	12	79
Needs for library services, operation of library	14	77
Academic training of technical personnel Information on IRIs with particular capabilities	15	75
Evaluating research programs Information on industrial equipment	17	72
Needs related to physical testing	19	70
Planning research programs Needs related to chemical/biological testing	20	68
Assistance in administration of IRI Financing technical services Assistance in selecting research programs	22	65
Assisting in planning, organizing and operation of IRI Assistance related to chemical/biological analysis Needs associated with standards or approval testing	25	63
Financing buildings	28	58
Assistance in planning buildings, other physical facilities	29	51
x Justification of establishing institute	30	35

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