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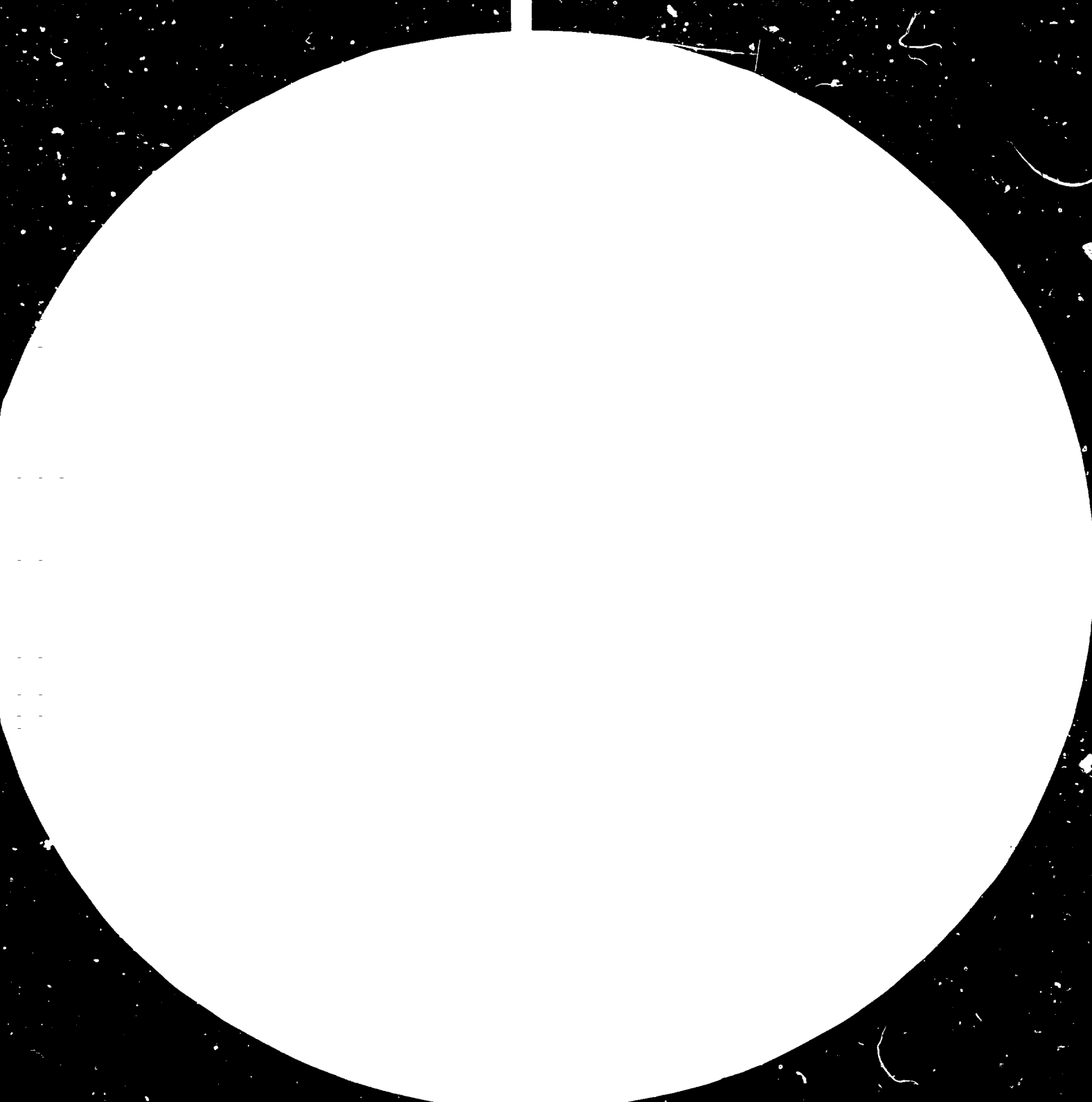
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PROCEEDINGS OF THE FIRST MEETING ON CO-OPERATION BETWEEN  
SCIENTIFIC AND INDUSTRIAL SECTORS IN MICROELECTRONICS\*

Mexico City, Mexico, 14 and 15 June 1982

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## INTRODUCTION

1. As part of the project for establishing a National System of Technology Perspectives, executed by UNIDO <sup>1/</sup>, a first meeting on the linkages between the scientific and industrial sectors in microelectronics was held in Mexico City, on 14 and 15 June 1982. From the Mexican side, a number of government officials, representatives of industry and of research institutions including universities participated. From the UNIDO side, UNIDO staff members and consultants participated.
2. The main objective of the meeting was to establish a sound basis for specific and direct linkages between universities, research centres and industry in the field of microelectronics, so as to serve the objectives of the National Systems on Technology Perspectives and more specifically, technological development in this field in general.
3. Before the detailed exchange of views, a presentation was made by the UNIDO Secretariat on the concept of a National System of Technology Perspectives. Mexican government officials made presentations covering the importance of computer electronics; the industrial policy thereon; policies relating to foreign investment and transfer of technology; the government's informatics policy; its approach to telecommunications; and its commercial policies in regard to computer electronics.
4. The report is divided into two parts. The first part describes some of the salient points discussed in the meeting. The second part enumerates the important points for action that emerged from the discussions, as summed up by the UNIDO Secretariat.

### I. DISCUSSIONS

5. Microelectronics, it was noted was changing the entire profile of industry and other economic and social sectors. The options for developing countries could be either to take the short-term view

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which might lead to excessive imports and a series of other problems, or to take a long-term view which would ensure a sound industrial and technological development in this field. In the past, taking a short-term view in other sectors had led to inappropriate and excessive imports, low manpower skills, problems of maintenance and in general increased technological dependence. Such experience should not be repeated in the case of microelectronics. The development of microelectronics should not be viewed merely as an exercise in import substitution but rather as the creative utilization of its potential for the benefit of the country.

6. The Mexican Government has put the emphasis on professional microelectronics in the Industrial Development Plan. It has also announced a special programme for the development of this sector which provides facilities and encouragement to enterprises. Its special programme covers the manufacture of electronic computer systems, their main modules and peripheral equipment. It pays particular attention to technological development and exports and provides tax incentives and differential prices in the consumption of energy products to registered manufacturers. With the objective of increasing the local content in terms of components and technologies it has developed detailed guidelines on the degree of incorporation of Mexican-made production and technology (T factor). In these guidelines, increased weightage is given to local production of integrated circuits and basic electronic components, and to research conducted in co-operation with research centres. Each enterprise is expected to allocate for research and development expenditure five per cent of its total sales. As a result, something like US\$500 million per annum were expected to be channelled to R and D in this sector. The intention was thus not only to create a local manufacturing capacity for components but also a technology capacity with a horizontal spread with a "push" effect in the economy.

7. Another relevant provision is a decree that establishes tax incentives to promote the research, development and commercialization of national technology, in particular through encouragement of the establishment of technological enterprises. Other relevant provisions included the general legislation relating to domestic and foreign investment and transfer of technology as also the use and exploitation of patents and trademarks.

8. There are several elements in the public sector of the economy which call for a sound and rapid development of microelectronics. One of them is the purchase of computers and other relevant equipment in the public informatics sector, which is governed by a purchase policy laid down by the government and administered by a special unit in the Secretaría de Programación y Presupuesto. Another is the telecommunication sector where long-term plans put particular emphasis on digitalization, switching and the wide use of radio and TV sets, all of which would require large inputs from the microelectronics sector. A research and development centre for telecommunications had also been set up.

9. The meeting recognized that the development of software capacities should be an important national objective in the microelectronics sector. The programme on computer electronics and the law concerning technological enterprises may have to give greater attention in a more specific and direct manner to the promotion of software. It was noted that some exports of software from the country had commenced and several small firms existed. It was also noted that exports of software would increasingly figure in international trade and that the General Agreement on Tariffs and Trade (GATT) was expected to consider international trade in the services sector at its next session.

10. The question of protection of software was discussed in detail. Here, three types of protection were relevant, i.e. patent, copyright and know-how protection. As regards patent protection, while the United States Supreme Court has ruled on



the patentability of software, the position is still fluid in several countries while some other countries such as France and Poland have decided against patent protection. Debate on this subject has been going on in several countries for the past ten years or so. As regards copyright protection, it was ineffective since it only protects the text of a programme which could be easily changed in minor respects. As regards know-how protection, it will be part of licensing arrangements which will authorize the use of programmes and may therefore be effective. However, software was increasingly being incorporated in hardware and the resultant firmware would be easier to protect. It was also pointed out that protective measures should not lead to unnecessary secrecy and restrictive clauses.

11. The position in this respect in Mexico was that the current industrial property law did not have specific protection for software. A degree of protection was provided through the contracts between foreign suppliers and domestic recipients. Mexico was carefully studying the trends in regard to software protection in other countries and would continue to do so before enacting specific policy measures.

12. In this connection, it was also mentioned that apart from legal protection, there existed a kind of technical protection through the incorporation of software in hardware, which might also lead to reduction in software costs. There was also a kind of cultural protection, for example in the Spanish-speaking world, where a unique market in the software sector existed in Spanish language. The requirements of this sector needed to be explored.

13. As regards the enterprises, particular attention was drawn to the problems of small enterprises in this field and it was suggested that the Mexican Government should pay special attention to them. They lacked the necessary financial resources, in particular of venture capital. R and D centres were not particularly

keen to collaborate with small enterprises and often five per cent of the sales of a small enterprise may not yield a viable amount on the basis of which a research programme could be contracted. In this connection, several suggestions were made, such as the development of common R and D programmes for small enterprises by pooling their resources; providing matching funds for the amounts arising from the five per cent contribution of the enterprises; taking advantage of the shared-risk programme of the CONACYT; and the stimulation of interest of R and D institutions for research work of small firms by giving the former a running royalty on the product developed. It was felt that in any event the size of the small enterprise sector in Mexico and their problems could be studied in detail by the government, particularly because small enterprises often provided the dynamic elements in the innovation process in microelectronics.

14. As regards the R and D centres, it was noted that while some instances of successful co-operation between them and the industry had existed, leading to the commercialization of products, there was by and large a communication gap between them. Some enterprises had still to develop confidence in the R and D centres to contract out research, while some centres had been engaged in research with little linkages to industrial enterprises. On the whole, the T factor in R and D had not been given sufficient attention. In this respect, it was noted that the structures of universities and other academic institutions had been designed in a different context and they did not permit, for example, the quick conclusion of contracts with industry and flexible linkages. Universities were also autonomous institutions and in this respect had to be distinguished from government R and D centres. It was felt that the R and D facilities available in the research institutions were not generally known to industry and one of the first steps in promoting linkages between the two sectors would be to make this information available. The fact that provisions for R and D contained in the programme for the development of computer electronics would result in a research effort of some US\$500 million per annum, necessitated that R and D institutions will have to review their facilities and structures and gear themselves for the demands that will be made of them. In particular, there would be an increased demand for skilled professionals and long-term plans to meet this demand would have to be drawn up.

15. It was pointed out that enterprises often needed R and D of a short-term nature to solve immediate production problems. A certain amount of informal R and D was also carried out in enterprises. It was stated that such factors should be taken into account so as to avoid an undue stress on research in public R and D institutions. It was also recognized that the term R and D should be viewed broadly as encompassing the stage of identification of a particular programme right up to the marketing of an economically feasible technological means to solve the problem.

16. Suggestions were also made to establish a long-term programme in microelectronics in which each of the participating elements represented in the meeting could together contribute to the development of a sound microelectronics industry in Mexico.

17. It was generally agreed that a meeting of this type was particularly useful to make enterprises and R and D sectors aware of their mutual activities and problems and that such exchange of views should continue to be held. Greater focus on industry-oriented R and D could be achieved, it was suggested, through the establishment of innovative institutional structures. In this connection, examples of the Korean Advanced Institute of Science and Technology (KAIST) and of institutes jointly owned by industries and universities were cited. In general, there were a series of short and long-term problems to which the industry, the research institutions and the government had to jointly address themselves. A first step in this regard was greater information on the relevant activities and articulation of problems.

## II. RESUME OF POINTS EMERGING FROM DISCUSSIONS

18. Summing up the principal points that emerged from the discussions, a representative of the UNIDO Secretariat stated that it was clear that considerable awareness of microelectronics and its importance

existed among large, medium and small enterprises in the electronics business and research units in specialized institutions as well as universities. The government had also drawn up a development programme for the manufacturing of electronic computer systems, their main modules and peripheral equipment. As a result of a provision that five per cent of the value of production of each enterprise in this field should be allocated to R and D, some US\$500 million were expected to be available each year for R and D. It was also relevant to note that a decree existed establishing tax incentives to promote research, development and commercialization of national technology. Consideration may have to be given to certain activities in the further development of microelectronics efforts in Mexico, based on the discussions. Such activities may have to be measures of both a short-term and long-term nature.

19. The short-term measures would include:

- (a) Action on the part of the R and D centres to:
  - (i) clearly specify for the benefit of the enterprises the facilities available for carrying out research and development so that the demand and supply could be matched;
  - (ii) to streamline their contractual procedures for entering into R and D arrangements and suggest model contracts to minimize the time of negotiations; and
  - (iii) in general, to gear themselves up in terms of equipment and manpower to match the demands that will be made on them.
- (b) (i) The government may consider drawing up and publishing an indicative list of thrust areas for research and development in this area, taking into account any guidelines which might already have been formulated.

While a part of the R and D to be carried out will arise from the urgent short-term needs of the enterprises, the indicative list could identify other areas of national importance as could be derived from anticipated technology trends as also the needs of major user sectors such as telecommunications, energy, petroleum and informatics in the public sector; and

(ii) the government could also examine the activities of small and medium firms and their problems so that adequate programme and policy support is made available to them.

(c) Enterprises should start identifying and articulating their R and D needs to enable the government as well as the research institutions to have a clear picture of their needs.

(d) Proposals and documentation on the above could well form the agenda for the next in a series of meetings proposed to be held among government agencies, enterprises and R and D institutions in the field of microelectronics.

20. As regards long-term measures, the government, in interaction with industry and research institutions, may have to give consideration to the following:

(a) The possibility of setting up specialized inter-disciplinary centres, taking into account the institutional basis that already exists in the country. Examples of such centres include KAIST and institutes of technology jointly established by industry and universities with an inter-disciplinary content including the discipline of management;

(b) A long-term manpower plan for the microelectronics sector should be drawn up as the research programme itself would need a substantial number of trained professionals over and above those needed for manufacturing;

(c) The long-term policy should not aim merely at important substitution. It should aim at a creative utilization of microelectronics for fulfilling social needs. It may be necessary

to draw up a 10-year plan for this field, identifying the long-term role of government, enterprises, R and D centres as well as the user sectors and specifying production and technology goals to be reached;

- (d) A special programme and special incentives for development of software may be required.

21. It may be useful to constitute an inter-disciplinary group under the National System of Technology Perspectives, which could take up from time to time problem-oriented issues for action and also review the technology trends in this sector. Such a group should include:

- (i) representatives of small, medium and large enterprises;
- (ii) R and D centres;
- (iii) concerned government departments; and
- (iv) major users.

22. Out of the information generated by administrative approvals under the relevant regulations, an information and monitoring system should be created which will enable the National System of Technology Perspectives to have a broad configuration of the R and D efforts in the country.

23. Regarding legislative measures, the government may have to keep under review the relevant provisions for patents, copyright and transfer of technology. In particular, the question of patentability of software, which is still under discussion in many countries, would have to be kept under review. The law concerning technological corporations may also need review to provide incentives to software and other skill-intensive activities.

24. In view of the fact that an Expert Group Meeting on the Implications of Microelectronics for the Latin American Region had recommended the elaboration of a co-operative Latin American programme in the field of microelectronics, consideration may have to be given to linking up Mexican activities with the co-operative programme for the mutual benefit of participating countries.

25. UNIDO, on its part, while continuing to assist through its project the National System of Technology Perspectives and carrying out a sensitizing and promotional programme in the field of microelectronics, would consider requests for technical assistance and advisory services within the framework of its established programmes.

26. Mr. Hector Alvarez de la Cadena, on behalf of the Secretaría de Patrimonio y Fomento Industrial (SEPAFIN), referred to the need to keep in mind the ultimate objectives to be achieved through industrial and technological development in microelectronics and to draw up national priorities in order to achieve optimum results. The research and development effort should ultimately contribute to the national goals such as self-determination in technology, maximizing comparative advantage, etc. In view of the limited financial and manpower resources, it will be necessary to rationalize their use. The R and D effort was important as it will have a multiplier effect over a wide range of the economy. He expected that further meetings of this type would be held to advance the process already initiated.

27. A questionnaire was circulated in the meeting to enable the compilation of an inventory of available facilities of R and D institutions in this field.

