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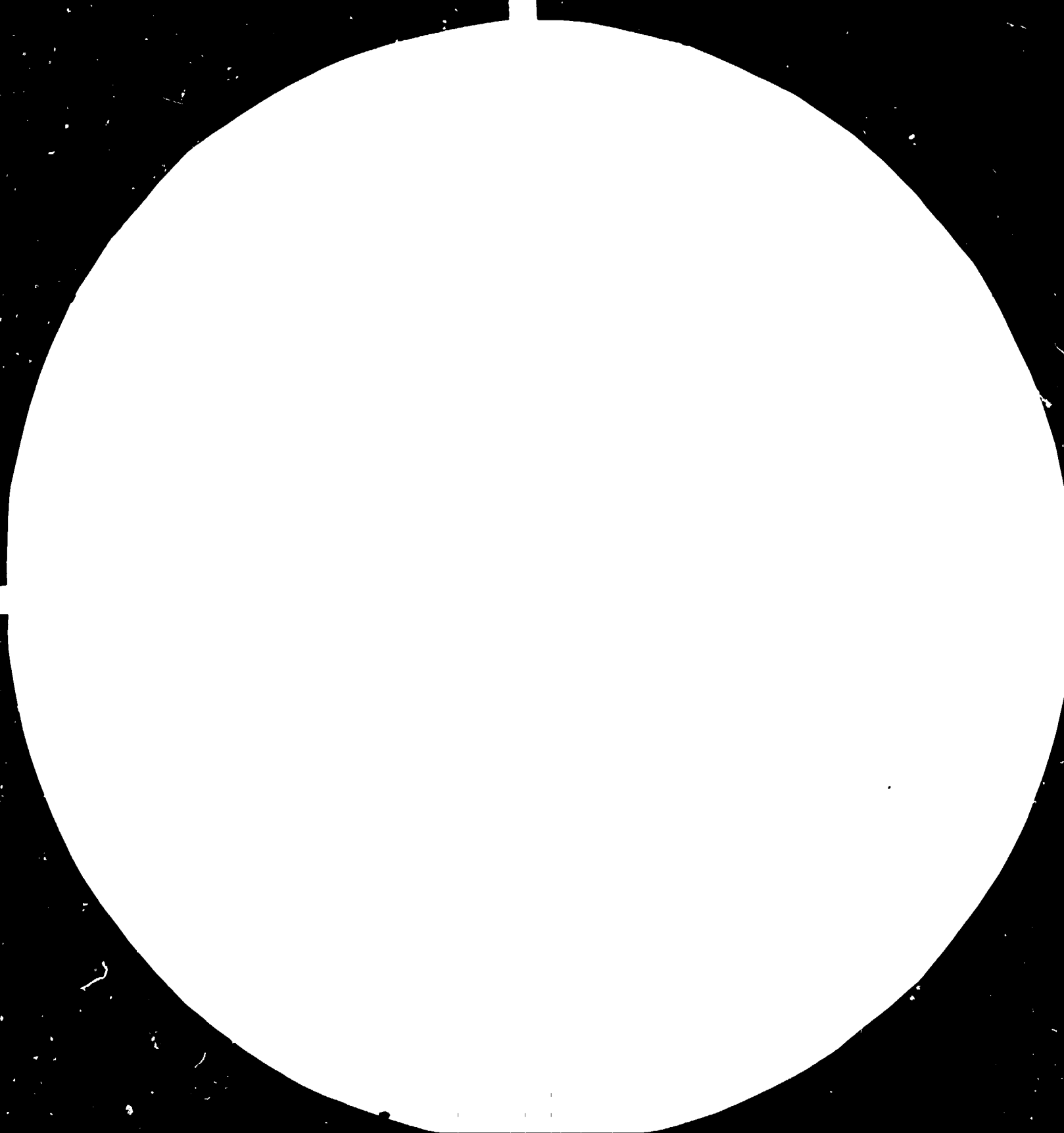
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in the ECLAC Region (REMLAC)*

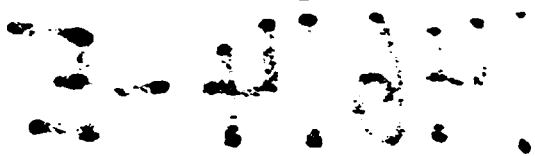
Caracas, Venezuela, 3-7 June 1985

PROPOSED STRUCTURE OF THE REGIONAL NETWORK FOR MICROELECTRONICS
IN THE ECLAC REGION**

a note prepared by the UNIDO secretariat

* Co-sponsored by SELA/ECLAC.

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Contents

	Page
Background	1
Structure of the network	5
Action required	9

The ideas contained in this note on the proposed structure of the Regional Network for Microelectronics^{*/} in the ECLAC Region (REMLAC) have evolved over a period through: the UNIDO/ECLA Expert Group Meeting on Microelectronics in Latin America in June 1982; exchange of views by UNIDO staff members with policy makers in several countries in the region; the views of a group of three eminent experts who visited Venezuela in November 1983, and elaborated the idea of the network; and the findings of an expert mission which discussed the idea of the network with policy makers in Argentina, Brazil, Mexico and Venezuela. The note incorporates the findings of the experts on an appropriate structure for the network.

Before discussing the proposed structure, it is necessary to take note of the background, in particular the Latin American context and the nature of the microelectronics industry.

Background

The Latin American and Caribbean region accounts for some 50 per cent of the industrial production of the developing countries. Some of the countries in the region have a relatively developed industrial structure and have also started exporting manufactures. The advent of microelectronics is therefore of particular relevance to Latin America and has implications for the development of the region and its competitive ability in international trade. It can be said that the question before the Latin American countries in regard to introduction of microelectronics is not whether they should introduce it but rather how. The UNIDO/ECLA Expert Group Meeting on the Implications of Microelectronics for the ECLA Region, held in June 1982, was decidedly in favour of taking a positive and dynamic approach to the introduction of microelectronics technology in the region within a long-term perspective and based on an integrated strategy which would maximize the potential of microelectronics for unique developing country requirements. The opportunity-cost of not introducing the technology was considered obviously too high.

^{*/} As defined, for this purpose, as a broad term to cover developments in computing, systems analysis, telecommunications and microelectronics.

The present state of the electronics industry and the introduction of microelectronics in the region varies as between countries and in regard to the depth of capabilities acquired. One of the earlier introductions of microelectronics was through imports of computers and related systems. It gave rise to problems of excessive imports, underutilization of capacity, maintenance difficulties and lack of software. Based on the experience in this respect, several countries in the region have found it necessary to establish informatics departments or secretariats to regulate the purchases of computers. Some countries, like Brazil and Mexico, have also started production of mini and microcomputers. Applications of microelectronics have been adopted in telecommunications and a number of industries such as petroleum and petrochemicals, chemicals and automotive industries. A number of research groups or centres have been established, though the research pertains more to hybrid circuits than to integrated circuits. Given the dynamic state of the technology and its potentials and implications, obviously far more work has to be done. Recognizing this, the UNIDO/ECLA Expert Group Meeting on Microelectronics recommended the initiation of a Latin American Programme of Co-operation in Microelectronics.

Taking into account the recommendations of the Expert Group Meeting, the continuing interest expressed by several countries in the region for networking and co-operation activities and the urgent need for regional co-operation in this dynamic industrial and technological sector, the time is considered ripe for the establishment of a Regional Network for Microelectronics in the ECLAC region (REMLAC). The substantive elements which should go into the establishment of the network already exist.

The UNIDO/ECLA Meeting spelt out those elements as follows: "The meeting resolved that a Latin American Programme of Co-operation in Microelectronics should be initiated. It recommended that for this purpose UNIDO and ECLA in co-operation with other concerned organizations should elaborate the Programme on the basis of discussions with interested governments and institutions and ascertain their needs and priorities in different sectors. The programme should have regard to co-operation in areas such as early identification and assessment of technological advances in microelectronics; exchange of information and co-operation in regard to public purchases; the establishment or expansion of plants for the design and production of microelectronic components and all interface elements; identification of application

possibilities in critical and priority sectors relating to domestic and external markets, specialized "centres of excellence" to promote and carry out research and development and applications including centres in industry or working in close co-operation with industry and networking of such centres; conduct of feasibility studies, training of manpower and reversal of brain drain; socio-economic assessments of the impact of the technology etc. The programme will evaluate and identify formulas for the promotion of R&D with specific relation to mechanisms of public policy. Under the overall programme, several regional co-operative projects in specific subject areas should be elaborated. In addition, interregional possibilities should also be examined and evaluated with a view to establishing co-operation agreements. The Programme should fully take into account existing institutional capabilities and ongoing efforts in the region so as to avoid duplication and enhance its effectiveness". More or less the same activities were also identified as elements of a Latin American Programme of Co-operation which was recommended by the Second Meeting of high-level governmental experts in the field of science and technology, held by the Sistema Economico Latinoamericano (SELA) in May 1984, later supported by the Tenth regular meeting of the Consejo Latinoamericano in October 1984 (Decision No. 200). REMLAC would be the instrument through which the elaboration and implementation of co-operative programmes can be effected.

While the activities indicated in the previous paragraph are in terms of functions, the wide range of microelectronics technology should also be taken into account. The microelectronics technology can be broadly thought of as covering the following areas of specialization:

1. Design and fabrication of IC devices (digitals);
2. Design and fabrication of IC circuits (LSI/VLSI);
3. Design and fabrication of thick- and thin-film hybrids;
4. Design and fabrication of IC microwave devices and circuits;
5. Design and fabrication of opto-electronic devices and circuits; fibre optics and related technology;
6. Power devices, SCR's etc.;
7. Photovoltaic and solar cell technology;
8. CAD for IC and hybrid technologies;

9. Microelectronics applications: customized sub-assemblies and systems; related application and system software generation;
10. Materials technology for microelectronics.

The spectrum of specialized sub-technologies presented above is a design-intensive one. It is also a very capital-intensive technology if one wants to make a significant impact in terms of realizing products, services and applications. It would be unreasonable to expect a single organization or even a single country in the region to be able to master all the facets of this technology. In the context of meeting developing countries' needs this is an ideal technology for promoting horizontal linkages among the developing countries in the region resulting in the creation of a regional network of specialized centres assisting one another with their complementary strengths.

In the Latin American region, it would appear that significant strengths have been built up in one or more of the earlier mentioned facets by at least four countries: Argentina, Brazil, Mexico and Venezuela. Detailed investigations would undoubtedly have to be made to establish in which aspects specific strengths in this technology have been already built up by each country. Brazil seems to have made major investments in mastering facets (1) and (2) and possibly others. In Argentina, too, significant steps seem to have been taken to master IC technology at the pilot plant production level. In microelectronics applications, major efforts seem to have gone into meeting demands in the bioengineering and medical electronics areas. In Mexico considerable emphasis seems to have been placed on microelectronics applications in the communication areas and in software generation.

In Venezuela, the Fundación Instituto de Ingeniería is engaged in a broad range of microelectronics activities centred on the following facets of the technology: hybrid circuits, power devices, fibre optical devices, microelectronics applications in process monitoring and control (especially aluminium industry), applications in data acquisition, monitoring and control of oil production and refining, networking of microprocessors and specialized data-acquisition devices, digital image processing application in the oil industry and other applications in exploiting solar energy. Also in other countries of the Latin American and Caribbean region there are several institutions being active in the microelectronics field and advantages in creating a scientific and technological co-operation among all those centres and organizations are evident.

Structure of the network

The main idea of the network can be summed up in the expression "increase in collective self-reliance". Such a network would link together scientific and technological capabilities, hitherto dispersed, which would find it easier to grow together and to keep in the forefront of international development in this field as well as to render necessary services and introduce innovations in their respective countries.

The essential function of the network will be the establishment of effective mechanisms for flows of information and organization of events among its members which will facilitate the carrying out of co-operative activities and keep its members informed not only of their own activities but also the international trends in this field. It is advantageous that the network does not establish a new secretariat. The nodes which host the periodical meetings of the network could function as its secretariat, as explained later.

Flexibility, structural as well as organizational, is suggested in the creation and operation of the network. It is assumed that any form of co-operation advantageous to the partners may be established within the scope of the network. The co-operation may be bilaceral as well as multilateral provided that the information concerning substance of co-operation will be available to all participants of the network and any interested participant may join an already established co-operation arrangement.

It is proposed that R² C be organized from June 1985 as a pilot project. It could operate on this basis for six years. After this period a detailed evaluation may be performed and decisions on its future reached. This does not imply that during the operational period no evaluation will be performed. On the contrary, it is expected that all activities of the network will be periodically evaluated at the annual meetings of its participants.

The main elements in the network would be:

1. The objectives pursued by the network members through the functioning of the network. A set of long-term objectives should be carefully spelled out when creating the network and should gain

the agreement of the initial members. It should be possible to modify them when other institutions join the network or when circumstances change. Short-term tactical objectives to guide activities in the network should be adopted at the periodic annual meetings and would normally be expressed in a work programme for the coming period. A separate note is circulated on the work programme of the network. The success of the network will depend on the programme it is able to carry out.

2. The nodes, i.e. the national centres or groups that make up the network. They may assume different characteristics, but in general would have R and D and applications capabilities. The network would accept only one node per country; other local centres should link up through the national node. The nodes would interchange flows of knowledge resources with other nodes. At present there are in Latin America several countries with sufficiently developed centres that may constitute nodes for this network; but there is scope and indeed necessity for each participating country to develop a node. An important function of technical co-operation through the network would be to identify potential nodes in other countries and to help them build up their capabilities so that they can participate fully in the network activities.

The nodes will formally interact through annual meetings of the network. These meetings may rotate between members of the network who will host such meetings in turn and pay for the travel of the participants. Alternatively, each country may finance the participation of its representative in the network. The annual meetings will elaborate the elements of co-operation and programmes within the network which can then be carried out in a manner agreed upon by the countries participating in each activity. Each node which hosts a meeting of the network may function as the Secretariat till the next meeting.

3. The regional nodes will be formed by national institutions which can function as "regional centres of excellence". Considering the wide range of activities in the field of microelectronics more than

one regional node will be required. In this context and following the offer of the Government of Venezuela, a group of experts evaluated the facilities of the Fundación Instituto de Ingeniería. Through this evaluation the viability of the Fundación to function as a regional node was established and proposals for upgrading its facilities are under consideration. It is hoped that other regional nodes will be identified through the activities of the network.

The group of experts recommended that the Fundación may function as a regional centre of excellence specializing in the following activities of microelectronics technology primarily, taking into accounts its past activities and its future plans:

- (i) Design and fabrication of thin and thick-film hybrids;
- (ii) Design and fabrication of auto-electronics devices and circuits; fibre optics and related technology;
- (iii) Power devices, SCRs, etc.;
- (iv) Photovoltaic and solar cell technology; and
- (v) Microelectronics applications; customized sub-assemblies and systems; related applications and systems software generation.

It should be noted that the arrangements should be flexible to permit, if necessary, more than one institution to function as a centre of excellence in a given facet of microelectronics technology.

4. The links between the nodes, or channels through which flows would take place. The establishment of stable links is one of the more important tasks which should be undertaken when the network is created. A rapid and easy circulation of flows depends on stable, fluid and reliable links. Other networks have traditionally employed links such as consultation mechanisms, periodic meetings, bulletins etc., in addition to personal contacts of different types. In the case of REMLAC, innovative networking practices could be adopted through the appropriate deployment of the very microelectronics technology that is of central concern to REMLAC.

5. The flows circulating throughout the network between the nodes. Such flows may include the following types of "knowledge resources": (a) knowledge (substantive knowledge on microelectronics and its applications and on related fields; policy knowledge related to the development and use of microelectronics); (b) technology (usually in the form of "packages" or readily applicable solutions that may include design, software etc.); (c) technical and scientific services (analyses, documentation, training, advice on various problems, formulation of projects and programmes); and (d) information (on knowledge resources and on social and economic parameters). Most of these flows will originate within the network, often as a result of joint activities, but there may be significant flows coming from the outside, particularly in relation to a monitoring task which may be shared by the nodes. A particular issue has to do with technology flows insofar as there may be proprietary rights which may impede free transmission to other nodes. This is a point to be considered carefully.

6. The joint activities undertaken by two or more members of the network such as: R and D; training, the establishment of common standards, specifications, procedures, norms and codes, the formulation of common policies, for instance for joint action at the international level. These activities may be designed and carried out as projects, which should be carefully prepared by the participating nodes. Projects will constitute temporary co-operation networks around a single topic, and will generate intense flows between the participants. R and D projects may be of two types. In the first place, they may refer to substantive questions - i.e. to R and D in microelectronics and related topics. Secondly, they may deal with policy issues which need "policy research" of a multidisciplinary nature, possibly with the participation of economists, lawyers and other social scientists. A programme of joint activities is proposed in a separate note.

7. The funding of the activities to be carried out within the network. The importance of this aspect should not be minimized since the smooth and efficient functioning of the network depends

on it. Pluriannual budgets should be prepared and financial resources marshalled; projects and joint activities should not be started if funding is not assured. The main sources of funding would be the participating countries themselves; the UNDP; and various international foundations.

UNIDO as the promoter of the network may provide, within its limited budgetary resources, organizational support for the periodic meetings as well as provision of outside experts on specific topics during the meeting. In addition, UNIDO's support will also be available through regional or national projects for which it will be the executing agency at the request of the countries concerned. At the request of participating governments UNIDO may also provide outside expertise to assist in identifying national centres of excellence.

Ultimately, the REMLAC network should become a true co-operation system. This requires that several conditions be met: clearly defined long-term objectives that are shared by the network members; firm and stable links among the latter; an intense circulation of flows so that through them true systemic relations are established; the carrying out of joint activities with sufficient continuity; and exchanges of flows (mainly information, knowledge and technology) between the nodes and outside institutions in such a way that there is mutual knowledge and a similar approach. If these conditions are obtained and a system is forthcoming rather than a simple network, there will be better possibilities that the efforts and resources assigned to co-operation in REMLAC will produce a higher return through a significant improvement of the efficiency and efficacy of the member institutions.

Action required

Representatives of participating countries are requested to:

- (i) consider and agree on the proposed structure of the network;
- (ii) indicate the readiness of their countries to participate in the network;

- (iii) if possible, indicate a nodal point in the country for the network; and
- (iv) indicate activities through which they can contribute to the network or benefit from it.

