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**THE UNIDO PROGRAMME OF TECHNOLOGICAL ADVANCES:
MICROELECTRONICS***

Note prepared by the
Transfer of Technology Programme Branch

* This document has not been edited.

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1. Following the Third General Conference of UNIDO in 1980, a major new programme of activities was initiated by the Technology Programme of UNIDO dealing with the potentials and implications of technological advances for developing countries. Those advances are not only creating new industries but have substantial implications for a number of other industries. The convergence of these technological advances itself produces an interaction, which in turn has implications for the pattern and rate of industrial production in developing countries. In other words, in planning their industrial development and for achieving the Lima target,^{1/} developing countries have to recognize that the present and coming decades are likely to witness substantial changes in production patterns owing to the expected interplay of the new advanced technologies. These technologies have potential as well as limitations for developing countries and it should be part of the industrial and technological strategy of each developing country to see how it can tap the potential of the new technologies without being affected by their limitations.

2. The Fourth General Conference of UNIDO which took place in Vienna from 2-19 August 1984 included an agenda item on the subject of strengthening the scientific and technological capabilities for industrial development in developing countries. In the debate on this item attention was drawn by the Secretariat to the changing technological world scene and the consequent need for the developing countries to rectify past deficiencies and to come to grips with the new situation. As technological advances were expected to affect a wide range of industrial sectors, it was necessary for each country to reduce to a minimum the adverse consequences of those advances and to maximize their benefits through a selective and differentiated policy adapted to its own requirements. UNIDO's programme in microelectronics was commended and support was expressed for promoting the establishment of regional and international centres for selected technologies including the networking of existing institutions in the respective regions. Developing countries may identify gaps in existing arrangements with a view to considering setting up national, regional and interregional facilities and networking existing centres including research and development institutions.

1/ The Second General Conference of UNIDO, held at Lima, Peru, in March 1975, set a target of a 25 per cent share of world industrial production for the developing countries by the year 2000.

3. The Conference also recognized that the new technologies will have a wide-ranging impact on industrial development and endorsed the importance of strengthening scientific and technological capabilities for industrial development in developing countries; it urged UNIDO to assist developing countries in building their technological capabilities in different fields of technology including the setting up of national groups to monitor and assess technological trends and the changing international market and promote core groups or institutions in selected technological advances.

4. The concept of promoting specific projects for international co-operation aimed at the betterment of the life of the poorest of the poor, which had originally been formulated at the International Forum on Technological Advances at Tbilisi (USSR) in April 1983, was also presented to the Conference. Its objectives were generally supported and there was agreement that appropriate technologies including advanced ones should be promoted and developed to meet particular needs of a clear urgency to mankind. Microelectronics is a suitable candidate technology as it can be beneficially employed in health care for the rural poor; educational and information purposes in decentralized locations etc.

5. The UNIDO programme on technological advances was designed, in particular, to increase awareness through early identification and assessment and to promote action at national, regional and international levels regarding:

- (a) The potential and limitations of various advanced technologies for the developing countries;
- (b) The industrial and technological capabilities that the developing countries need in order to be able to use advanced technologies where appropriate and feasible;
- (c) The policy actions to be taken by the Governments of developing countries with regard to advanced technologies.

6. In addition to expert group meetings, studies and current awareness bulletins, emphasis has been laid on:

- (a) Mobilizing the co-operation of individuals and institutions at the cutting edge of a particular technology;

- (b) Promoting national action by developing countries in terms of policies and programmes in accordance with their conditions and requirements;
- (c) Providing technical assistance, as required by developing countries;
- (d) Identifying and promoting developing-country-specific applications as also application in various industrial sectors.

7. Activities have been developed within the framework of the foregoing considerations, bearing in mind the nature of the technological advances and the type of practical action that would be most effective in each case.

8. The position in regard to microelectronics is described below briefly, indicating the activities carried out at international, regional and national levels.

Actions by UNIDO at the International Level

9. In June 1981 a meeting of experts was organized on the implications of technological advances in microelectronics for developing countries. The meeting emphasized the importance of actions at the national level relating to manufacture, industrial and other applications, software development and the formulation of a national microelectronics strategy. Actions at the international level were also recommended, including a continuous monitoring of observed trends and their impact on various sectors and the development of pilot projects and programmes dealing with applications and software.

10. Following the June 1981 meeting, a mission of experts visited four developing countries in different regions to promote selective applications of microelectronics and software development. Apart from reviewing the national situation in the countries visited, the mission recommended an approach to microelectronics application, including software and suggested models of microprocessor application centres and software houses. Also as a result of the June 1981 meeting, certain activities at the regional level were pursued. These are described in a later section.

11. The International Forum on Technological Advances and Development organized by UNIDO in Tbilisi, USSR, in 1983 as well as expert meetings in Moscow, USSR (December 1982), and Dubrovnik, Yugoslavia (June 1983), which respectively preceded and succeeded it, examined the subject of technological advances and development with regard to specific technologies of which microelectronics was an important one. A suggestion was also made in the Forum that an international centre for microprocessor applications should be established; as a starting point for examining the various requests for regional and international action, a series of country case studies have been initiated, aimed at the national level, but also to identify the scope for regional and international co-operation. It is expected these studies will provide concrete information and meaningful approaches for regional and international action. Country studies published so far cover Argentina, Bangladesh, Brazil, India, the Republic of Korea, Pakistan and Venezuela. An overview of the microelectronics industry in these countries has also been prepared.

12. In an effort to co-ordinate the activities of organizations and professional groups active in the area of information technology for development, the UNIDO Secretariat in 1984 convened a meeting in Vienna which brought together representatives of those groups, identified possible areas of co-operation and considered a mechanism for keeping mutually informed and for formulating joint programmes. In addition to representatives of organizations, selected specialists from developing countries were also invited to present their countries' policies and requirements. As a result of this meeting the Consultative Group on Informatics Technology (COGIT) was established which meets periodically to review ongoing activities, exchange experience and formulate joint programmes.

13. In its second meeting from 14 to 16 December 1987, also held also at Vienna, the COGIT group reviewed practical experience in the application of informatics technology for development and identified concrete measures of co-operation at international level, including co-operation among developing countries, so as to promote such applications in a manner consistent with the requirements of developing countries. The group adopted a number of conclusions and recommendations as inputs to the UNIDO programme in this area. It noted that developing countries were at different levels of development and would need to take action at one or more of them.

international co-operation, including South-South co-operation was called for. However, it was stressed, selectivity was important in view of the vastness of the field of informatics technology. UNIDO's programme on microelectronics/informatics for 1987-1989 was submitted to and supported by the COGIT group. In the present document it is dealt with in more detail under a separate heading.

14. The UNIDO Secretariat has tried to promote the concept of software as an industry and the actions that developing countries could take to promote that industry. The concept has been elaborated through three studies dealing with the importance of software for developing countries; the approach to software development in those countries; and guidelines for software production. Further work in this area would include the promotion and development of software for specific applications of relevance to developing countries including applications in various industrial sectors. A report on the commercialization of software: main issues and contractual terms and conditions, was prepared and submitted to the Ninth Meeting of Heads of Technology Transfer Registries. Through these efforts and by other means it is proposed to build up a bank of application software for the benefit of developing countries.

15. Information technology, as covered by the term "informatics" and extending beyond data-bank systems and networks to industrial management tools and industrial processes, is in a stage of dynamic growth, particularly through the use of microprocessors. UNIDO co-sponsored a Conference on Informatics and Industrial Development with the Irish National Board for Science and Technology and Trinity College, Dublin, in March 1981. The Conference highlighted the importance developing countries attach to information developments, which are of substantial consequence to current industrial development strategies. UNIDO has also brought out a publication on informatics and industrial development.^{2/}

16. In response to the articulated needs of Member States, UNIDO commenced preparatory work for the establishment of an International Project for Transfer of Microelectronics and Software Technology. The concept was worked out by UNIDO staff and has been preliminarily examined by specialists from private enterprises and universities as well as by government officials.

2/ "Informatics for Industrial Development", Development and Transfer of Technology Series No. 22 (or document No. UNIDO/IS.415).

Regional Level Activities

17. An Expert Group Meeting for the Economic Commission for Latin America and the Caribbean (ECLAC) region was held by UNIDO in June 1982 in Mexico, in co-operation with ECLAC, at which the socio-economic implications of microelectronics advances for Latin American countries were analysed and a Co-operative Latin American Programme of Action in the field of microelectronics recommended.

18. As a step in this direction a Latin American Microelectronics Network including the Caribbean (REMLAC) was proposed following a high-level expert team mission to Venezuela in 1983. At the request of the Government, the experts looked at the facilities of an existing national institution in Venezuela with a view to upgrading it with UNIDO's assistance to become a nodal point for the proposed network. At a meeting which took place in June 1985 in Caracas, Venezuela, REMLAC was established and a programme of co-operation among the participating countries was initiated (see also paragraphs 23-25).

19. A symposium on Microelectronics for Productivity held at New Delhi in April 1983 and co-sponsored by UNIDO requested UNIDO to take the lead in the promotion of the establishment of an Asian Centre for Electronics. National level studies in selected Asian countries have been undertaken to ascertain the needs for regional co-operation.

20. UNIDO has also co-operated with the Economic and Social Commission for Western Asia (ESCWA) in the preparation for and conduct of the Expert Group Meeting on the Development of Microelectronics in the ECWA region, 4-7 March 1984, Kuwait. Recommendations made at that meeting requested UNIDO, inter alia, to look into the possibility of establishing a silicon foundry with design facilities in the ECWA region. A UNIDO consultant undertook a preliminary mission in December 1984 which has been followed up by an in-depth study^{3/} of microelectronics facilities and capabilities in the countries of the region to assess the scope and potential in the region for design and fabrication of customized integrated circuits (ICs).

3/ Document UNIDO/IS.583: "Silicon Foundry and Design Centres in the Arab Region: Issues and Approaches".

21. An ESCWA/UNIDO workshop on a regional silicon foundry and design centres was jointly organized with the Government of Algeria and held at Sidi Bel Abbas on 27-29 January 1986. The workshop agreed on the main conclusion contained in document UNIDO/IS.583 that the establishment of a regional silicon foundry cum design centres with a network of national centres should be pursued in an evolutionary manner. Recommendations were made for establishing design groups and the implementation of a multi-chip project; market studies for application-specific integrated circuits; a feasibility study for one or two pilot-plant-level silicon foundries in the region; and upgrading the two existing bipolar facilities to serve the purpose of regional co-operation. The Arab Fund for Economic and Social Development and the Arab Industrial Development Organization expressed concrete interest in financing certain follow-up activities such as the feasibility study for the pilot silicon foundry; market studies as well as a project for an Arab multi-chip. UNIDO also supported the national workshop organized by ESCWA on Computer applications, on 26-29 March 1986 in Baghdad, Iraq.

22. In regard to Africa, UNIDO co-sponsored with UNCSTD, OAU and ECA a meeting of African scientists on the implications of new technologies in the implementation of the Lagos Plan of Action and the programme for the Industrial Development Decade for Africa. The meeting was held in Mbabane, Swaziland, from 22 to 26 October 1984.

23. A national meeting on applications of microelectronics and software was organized by UNIDO in Kenya and took place from 18 to 23 February 1985. Representatives from countries of the region such as Ethiopia, Sudan, Tanzania, Uganda and Zambia attended.

24. At request of the Eastern and Southern African Management Institute (ESAMI) (an intergovernmental body whose objective is to help improve the performance and management effectiveness of public and private enterprises and institutions in the member states of the Eastern and Southern African subregion), UNIDO initiated activities to establish an informatics development centre for the subregion. Preparations are under way for a mission to establish the needs of the Eastern and Southern African subregion in the context of its informatics development and to work out in co-operation with ESAMI the structure and modalities of the centre.

25. The Regional Meeting for the Initiation of a Regional Network for Microelectronics in the ECLAC Region (REMLAC), organized by UNIDO in co-operation with the Sistema Economico Latinoamericano (SELA) and the Economic Commission for Latin America and the Caribbean (ECLAC) was held at Caracas on 3-7 June 1985. Representatives from eight countries in the region, viz, Argentina, Brazil, Cuba, Guatemala, Jamaica, Mexico, Peru as well as the host country Venezuela participated. Representatives from the Junta del Acuerdo de Cartagena (JUNAC), the Latin American Technological Information Network (RITLA), the Caribbean Industrial Research Institute (CARIRI), the International Development Research Centre (IDRC) and the Intergovernmental Bureau of Informatics (IBI) attended as observers.

26. The meeting unanimously agreed on the structure as well as work programme of REMLAC and the network was established on a pilot basis as from 7 June 1985 for a period of six years. The detailed conclusions and recommendations adopted by the meeting are as follows:

27. The country representatives agreed that the institutions indicated by their governments in sub-paragraph (e) below shall perform functions as the Regional Network for Microelectronics for Latin America and the Caribbean (REMLAC) on the following basis:

- (a) The network is established on a pilot, inter-institutional basis from 7 June 1985 for a period of six years or until it acquires an intergovernmental personality, whichever is earlier.
- (b) The overall objective of the network is to carry out joint activities with the aim of strengthening technological capabilities in microelectronics in the participating countries individually and collectively, in order to apply the technology for meeting their specific needs;
- (c) Participation in the network is open to all countries in the Latin American and Caribbean region. The following countries represented in the meeting will be the initial members, i.e. Argentina, Brazil, Cuba, Guatemala, Jamaica, Mexico, Peru and Venezuela. The meeting called upon other countries in the region to join the network;

- (d) The network will comprise of, and operate through, national nodes, (i.e. national centres or groups) in the member countries. There will be only one node per country acting as the focal point and other local entities should link up to the network through the national node. National nodes may have different functional characteristics, but typically would include R+D and applications capabilities;
- (e) Representatives from some of the participating countries have indicated their national nodes as follows:

Argentina: National Electronics Programme, Subsecretariat of Informatics and Development

Brazil: Instituto de Microelectronics do Centro Technologico para Informatica

Cuba: Centro Científico Técnico

Guatemala: Secretaria General de Planificacion Economica (SEGEPLAN) (in the first instance)

Jamaica: National Computer Centre

Mexico: Instituto de Investigaciones Eléctricas (in the first instance)

Peru: Instituto Nacional de Investigación Tecnológica Industrial y Normas Técnicas (ITINTEC)

Venezuela: Fundación Instituto de Ingeniería

28. Following the meeting establishing REMLAC, a UNDP-funded regional project for strengthening microelectronics infrastructure and capabilities in REMLAC member countries started in 1986. The main objectives of the project are: strengthening capabilities in countries at earlier stages of microelectronics development; examining national and regional application possibilities in selected industrial sectors; strengthening capabilities in the acquisition of hardware and software; monitoring technology and market trends in microelectronics for policy formulation and decision making; strengthening design capabilities, including multi-chip design and fabrication, and establishment of silicon foundries; and establishing and strengthening semiconductor manufacturing capabilities in the region.

29. Initially, UNIDO fielded an expert who visited the nodal points in all member countries of REMLAC, i.e. Argentina, Brazil, Cuba, Guatemala, Mexico, Peru and Venezuela, to identify national activities aimed at strengthening

negotiating capabilities in the acquisition of hardware and software. Another suggested element of the REMLAC programme relates to the multi-project chip. UNIDO has approached high-level scientists and technologists in order to obtain their views on the multi-project chip activity for REMLAC. The general view was that the multi-project chip activity would be a very interesting exercise for Latin America and could be the basis for strengthening technological capabilities in Latin America in the field of design of custom and semi-custom chips.

30. In 1987 a mission of two international consultants was sent to REMLAC countries to determine in co-operation with national experts the needs and activities of each country individually as well as the potential for regional co-operation in the field of microelectronics/informatics. The findings of the mission, together with the questionnaires describing status, needs and expectations of REMLAC countries, and the papers prepared by the national experts were submitted to the Regional Bureau for Latin America and the Caribbean, UNDP, New York. Presently, the Regional Bureau is consulting with the Governments of the REMLAC countries on the mission's findings.

National Level Activities

31. At the national level, apart from the state-of-the-art studies commissioned, the UNIDO Secretariat has been assisting the Mexican Government in setting up a permanent national team to monitor technological advances through a project financed by the UNFSSTD. Under this project a national level workshop was held. Thereafter three experts specifically looked at the microelectronics industry in its several aspects and suggested, in the light of the technology trends in the world, the actions that the Mexican Government could pursue.

32. A number of technical assistance projects are being implemented by UNIDO in this field and an illustrative list of these projects is in Annex I.

33. Other activities in this field include: support to a training workshop in Brazil; studies on biomedical applications and power devices prepared on the basis of that workshop; a pilot project for a rural development information system in the state of Karnataka, India, and a field study on computerization

of small-scale sector industry in India. A national workshop on selected aspects of information technology was held in Argentina in March 1986, cosponsored by UNIDO and IDRC. UNIDO also assisted in the organization of a national Workshop on Microelectronics, Port-of-Spain, Trinidad and Tobago, 10-12 February 1987. The workshop identified priority areas of microelectronics and software applications in the country and issued recommendations for future development.

Programme for 1987-1989

34. Within the programme approach adopted by UNIDO's Development and Transfer of Technology Division, a detailed programme has also been worked out for the field of microelectronics/informatics. It is aimed at strengthening of technological infrastructure and capabilities in microelectronics (both in hardware and software) in the member states in order to apply the technology for meeting their specific needs. The activities will have national, regional and global dimensions and a selective approach resulting from different levels of development and aspirations of countries and regions. The framework of these activities is as follows:

- (1) The methodological support for formulating national policy will be provided. The main objective of the policy is the appropriate response of the country to technological change in microelectronics. The holding of national workshops can be a means of mobilizing the interest and co-operation of diverse government agencies, universities and research establishments. Another aspect of the country policy is related to the maintenance of hardware and software already available (it should be noted that the maintenance concepts for hardware and software are quite different) and also for greater utilization of existing computer facilities. The expected outputs beside the policy formulation will be development of core groups in less advanced countries, as well as small institutions to strengthen capacities related to application and related software development. Also national and/or sub-regional groups could be formed.

- (2) For all member states assistance is foreseen in identification of sectors where microelectronics applications are needed. Special attention will be paid to the following sectors: agroindustry, agriculture, education, capital goods and health care supporting industries. UNIDO's concrete activities will be aimed at methodological assistance for identification of sectors where there is an interest and potential for microelectronics applications as well as assistance in assessment what measures exist to involve and encourage enterprises. Assistance will be also extended for identification of institutions capable of developing R&D units, microprocessors application centres. The methodological guidelines as well as country studies dealing with the above-mentioned subject will be provided by UNIDO.
- (3) Special attention will be focussed on the creation of a base for software as an industry. Software application centres will be promoted at both national and regional levels. Existing software centres will be upgraded to serve as "centres of excellence".
- (4) According to the articulated needs of member states, the assistance in monitoring technology and market trends in microelectronics should be provided by UNIDO. To fulfill these needs the Microelectronics Monitor (on a quarterly basis) as well as surveys of specific technological developments will be published. A study on "Applications of Pattern Recognition and Image Processing to Industrial Problems in Developing Countries" and a survey on "Simulative Techniques" will be published by UNIDO.

On request UNIDO will also provide assistance for creating in the member states units aimed at monitoring technology development in microelectronics (both hardware and software). In this field a collective regional effort will be encouraged.

- (5) Especially for more technologically advanced countries UNIDO assistance will be provided in the sphere of strengthening design capabilities in microelectronics and, if requested, development of silicon foundries. This problem should be seen in the context of

infrastructure, technological environment as well as needs and goals related to the design activities. UNIDO will provide methodological assistance and advisory service in the following aspects of creation of design/production infrastructure:

- (i) Physical facilities and equipment;
- (ii) Creation of design group which in particular will perform the following functions:
 - (a) Application identification and investigation;
 - (b) Logical interpretation of application;
 - (c) Transposition of local requirements into circuit design;
 - (d) Development of a testing programme based on circuit design;
- (iii) Arrangements for fabrication of the design;
- (iv) Upgrading capabilities of designers;
- (v) Design software.

For fabrication of integrated circuits UNIDO will provide assistance either in the use of an integrated circuit manufacturing facility which may come into being in the next few years as a silicon foundry facility or establishment of a separate silicon foundry, if necessary on a pilot plant scale, which could serve the purpose of an integrated design facility involving, in addition to the fabrication facility, a network of design centres.

35. The component covering technical co-operation provides technical assistance and advisory services to establish microelectronics assembly and manufacture and to develop human and institutional capabilities, in particular in software and basic design. Applied research, and development of software related to microelectronics and its applications, public purchase of equipment and components, and acquisition of technology, are areas where UNIDO may promote exchange of information among Member States, providing advisory services as required.

36. In the area of training, four types of skills are required:

- o To identify and specify applications of microelectronics;
- o To identify, adapt, and develop software;
- o To promote wide adoption of microelectronic systems among local users; and
- o To service and maintain microelectronics systems.

37. Technical co-operation to stimulate and facilitate appropriate use of microelectronics systems will feature four things:

- Practice-oriented approaches, with initial applications fulfilling well-identified user needs or applying to products, processes and services already in local use. They should also be within the capacity of a local core group;
- Development of methodologies to promote and disseminate programme structurally as well as operationally, e.g. a regional structure link with a learning-and-improving-by-doing strategy that moves through a use, manufacture, improvement and innovation cycle;
- Harnessing and exploiting appropriate sources of technology assistance from other developing countries (as well as from developed nations);
- Building up a self-sustaining capacity through programmed training and build-up of experience and confidence among users and producers.

Relevant Publications Issued by UNIDO

38. The impact of microelectronics has been looked at in UNIDO's programme of industrial studies from the point of view of restructuring world industry. Two studies have been completed: "The impact of microelectronics on the international economic setting: the case of computer-aided design",^{4/} "Restructuring world industry in a period of crisis - the role of innovation: an analysis of recent developments in the semi-conductor industry".^{5/}

4/ UNIDO/IS.297

5/ UNIDO/IS.285

39. A quarterly bulletin, the Microelectronics Monitor, has been published by the Technology Programme since January 1982 to create awareness and provide current information to a target audience of policy-makers, scientists and technologists, particularly in developing countries. A survey of technological and market trends during 1982 - 1983 has been published by the Monitor.^{6/} A special supplement reviewing developments in flexible manufacturing systems (FMS) was published in February 1985.^{7/} A review of the state-of-the-art of Gallium-Arsenide research is contained in issue No. 15 of the Monitor.

40. A comprehensive list of documents published so far by the Technology Programme of UNIDO with regard to microelectronics is attached as Annex II.

6/ UNIDO/IS.438

7/ UNIDO/IS.539

ANNEX I

List of Relevant Operational Technical Assistance
Projects Implemented by UNIDO

COUNTRY	PROJECT NUMBER	PROJECT TITLE
Albania	DP/ALB/84/001	Electronic instrumentation, automation and process control development
Bulgaria	DP/BUL/81/002	Strengthening of the Institute for Industrial Cybernetics and Robotics
Bulgaria	DP/BUL/81/008	'Numerical Control/Computer Aided Manufacturing (NC/CAM) Metalworking Development Centre' (phase II)
Bulgaria	DP/BUL/82/001	Automated Production Instrumentation Centre (A.P.I.C.)
Bulgaria	UC/BUL/84/117	Assistance to the introduction of microelectronics in industry
Bulgaria	SI/BUL/87/801	Assistance in the implementation of graphic standards for computer aided design (CAD)
China	DP/CPR/80/050	Training and development of micro-computer systems application
China	DP/CPR/85/017	Strengthening of CAD/CAM Centre
China	DP/CPR/85/087	Qualification and surveillance laboratory for consumer electronic products
Democratic People's Republic of Korea	DP/DRK/79/003	Establishment of a pilot plant and training centre for bipolar digital integrated circuits
Democratic People's Republic of Korea	DP/DRK/84/001	Development of numerically controlled machine-tools
Hungary	DP/HUN/86/003	Establishment of computer aided engineering training on educational microcomputer network

India	DP/IND/82/019	Assistance to the metal-working industry in India - computer aids
India	DP/IND/81/025	Development of microprocessor based agro-dairy instruments
India	DP/IND/82/033	Computer aided design programme
India	DP/IND/82/034	Appropriate automation promotion programme
India	DP/IND/84/015	Semiconductor devices and electronic sub-systems for transportation
India	DP/IND/84/030	Microprocessor application engineering programme
India	DP/IND/85/062	Establishment of an electronics service and training centre, Ramnagar, U.P.
Iraq	SI/IRQ/85/804	Introduction of a computerized maintenance system in textile industry
Iraq	SI/IRQ/86/840	Improvement of the existing MINISIS system with the Specialized Institute for Engineering Industries
Malta	DP/MAT/86/002	Maintenance and servicing of electronic equipment
Morocco	SI/MOR/86/885	Immediate assistance to AGA-Ingénierie for the establishment of computerized engineering data bank
Poland	DP/POL/87/007	Development of computer aided design capabilities within the Polish machine building industry
Republic of Korea	DP/ROK/82/026	Mechanical engineering computer application (MECA) programme (application of CAD/CAM techniques in mechanical industries)
Republic of Korea	DP/ROK/82/031	Numerical control centre
Republic of Korea	DP/ROK/86/002	Establishment of the computer aided design (CAD) section within the dies and moulds centre of the Korea Institute of Machinery and Metals (KIMM)
Republic of Korea	DP/ROK/87/001	Automation of small and medium-scale industries

Seychelles	US/SEY/86/141	Computer-aided electricity demand management and supply planning (phase I)
Sri Lanka	DP/SRL/86/014	Computer aided design and computer aided manufacture centre
Tunisia	DP/TUN/86/003	Unité de conception et de fabrication assistée par ordinateur de moules au sein du CETIME/DO - CFAO
Turkey	RP/TUR/85/002	Assistance in establishing a computer aided design/computer aided manufacturing (CAD/CAM) training programme at Gazi University
Venezuela	UC/VEN/86/190	Assistance in upgrading Fundacion Instituto de Ingenieria (Venezuela, Caracas)
Vietnam	DP/VIE/80/035	Electronic and optical maintenance and repair centre
Yugoslavia	DP/YUG/87/014	Robotized production line for surface mounting of electronic circuits
Regional	DP/RLA/86/003	Preparatory assistance for a regional project for strengthening microelectronics infrastructure and capabilities in REMLAC member countries
Regional	UC/RER/87/018	Industrial robotics applications - preparatory assistance
Interregional	UC/INT/84/261	Technical co-operation between the Institute for Industrial Cybernetics and Robotics (Bulgaria) and the Instrument Design, Development and Facilities Centre (India)

ANNEX II

List of Documents Published by the UNIDO Technology Programme on the
Implications for Developing Countries of Advances in Microelectronics

Expert Group Meeting on Implications of Technological
Advances in Microelectronics for Developing Countries,
Vienna, 10-12 June 1981

- UNIDO/IS.246 Implications of Micro-Electronics for Developing Countries:
and Corr.1 A Preliminary Overview of Issues
- UNIDO/IS.242/
Rev.1 and Report on Exchange of Views with Experts on the Implications
Corr.1 of Technological Advances in Micro-Electronics for Developing
 Countries

UNIDO/ECLA Expert Group Meeting on Implications
of Microelectronics for Developing Countries,
Mexico, 7-11 June 1982

- ID/WG.372/1 Prospects of Microelectronics Application in Process and
 Product Development in Developing Countries by Michael Radnor
- ID/WG.372/2 Microelectronics and Government Policies: The Case of a
 Developed Country by Ernest Braun, Kurt Hoffman and Ian Miles
- ID/WG.372/3 Microprocessors and Productivity: Cashing in our Chips by
 Robert T. Lund
- ID/WG.372/4 Microelectronics and Telecommunications in Latin America by
 Edgardo Galli
- ID/WG.372/5 Microelectronics: Its Impact and Policy Implications by
and Corr.1 Juan F. Rada
- ID/WG.372/6 Potential Applications Suitable for Microprocessor
 Implementations: Some Illustrative Possibilities by James
 Oliphant
- ID/WG.372/10 Elements for the Formulation of a Regional Programme of Action
 in the Area of Microelectronics by Carlos Aguirre and Roberto
 Heredia
- ID/WG.372/11 Telecommunications and Microelectronics: Some Observations by
 E. Galli, M. Welch and R. Herrera
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