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Meeting of the Consultative Group on
Informatics Technology for Development

Vienna, Austria, 26-28 November 1991

REPORT*

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* This document has not been edited.

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I. INTRODUCTION

1. In an effort to co-ordinate the activities of organizations and professional groups active in the area of informatics technology for development, the UNIDO Secretariat convenes biannual meetings of the Consultative Group on Informatics Technology (COGIT). These Meetings bring together professionals from the field of informatics, identify possible areas of co-operation and consider a mechanism for keeping mutually informed and for formulating joint programmes.

2. In the past years the UNIDO Secretariat has promoted 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 several studies dealing with software development and applications for developing countries, the approach to software production in those countries, and guidelines for organizing software houses. Further work in this area would include the promotion of software links to industry for specific applications of relevance to developing countries.

3. The software which can be developed and deployed is determining the speed with which computing systems penetrate industrial and service enterprises and transform them to increase the quality and quantity of their outputs.

4. Software technology is now being recognized as a new important sector deserving development in itself. However, in the context of UNIDO's activities not all the elements of the new sector necessarily deserve attention. The most important elements of informatics technology from UNIDO's point of view may include the following:

(a) Industrial software applications;
(b) Software as a small-scale industry;
(c) New production technologies for software;
(d) Standardization and legal aspects in both hardware and software;
(e) Monitoring development of software technology.

5. The formal objectives of the Meeting held in Vienna 26 to 28 November 1991 were:

(a) To review practical experience in software production and applications and to identify concrete measures of co-operation at the international level, including co-operation among developing countries, so as to promote such applications in a manner consistent with the requirements of the developing countries;

(b) To review UNIDO's past and planned activities in the field of software and suggest a programme of action.

6. The participants from UN agencies from selected developing countries, and experts from industrialized countries are listed in Annex 1. The documents prepared for the Meeting are listed in Annex 2.
Mr. R. Narasimhan (India) was elected Chairman.

7. Opening the Meeting, Mr. Alberto Araoz, Deputy Director-General of UNIDO, underlined the significance of informatics, and especially software technology, to the industrialization process and the double opportunity they represented. They constituted a rapidly developing industry in themselves (especially the software sector) which countries could enter without having to invest heavily in capital equipment. These are a force for change in other industries; they transformed manufacturing processes, products and even the competitive environment itself.

8. Nevertheless, despite national and international efforts, it had to be recognized, as the Deputy Director-General pointed out, that in many cases the industrial application of informatics had failed to yield the results expected of them in developing countries. Similarly, the applications had not enjoyed the diffusion anticipated, thus reducing their impact on development. The task of the Meeting was therefore to help UNIDO identify and spell out the elements of a coherent software/informatics programme for UNIDO that would contribute most effectively to the progress of developing countries.

II. CONCLUSIONS AND RECOMMENDATIONS

9. After reviewing current trends in software in the context of informatics technology as well as the needs of developing countries in that respect, a number of conclusions and recommendations relating to inputs to the UNIDO programme in this area were adopted.

General Trends

10. The Meeting recognized three major trends in the software field:

(i) Increasing demand, particularly for software, in the wake of the most recent developments in microelectronic chips.
The availability of reasonably priced and powerful microelectronic chips is creating an increasing demand for system and application software based on those chips. Many urgent user needs could be satisfied most economically by taking advantage of these latest hardware developments. The demand is principally in the areas of distributed system software and applications software which supports easy-to-use man-machine interfaces and integrated hardware-software solutions.

(ii) Globalization of the software market.
The standardization of computer hardware brought about by mass produced microelectronic chips and the availability of a responsive global communication infrastructure (computer networks such as Internet) has led to close transnational co-operation among software professionals. Information transfer achieved by these new means of communication ensures the global community comparable levels of know-how. Ultimately, a product either succeeds globally or disappears; even 'niche' markets are being globalized.

(iii) Optimal quality of product, documentation and development processes.
As a direct consequence of the globalization of the software market, only products of the highest quality succeed. Quality refers to absence of design faults, ease of use and detailed documentation. It

is also accepted that software quality is determined by a rigorous development process and thus, emphasis is now placed on structuring the development process accordingly. Many software users have already begun to demand full accreditation of the software development process.

(iv) Increased cost of entry into the software market.

The globalization of the software market and the emphasis on assured software quality have led to a significant increase in the cost of entering the software market as a newcomer. In particular, the cost of global marketing can be prohibitive for a small company. Schemes, already promoted by UNIDO, for 'joint venture' co-operation and risk-sharing between companies in industrialized and developing countries are of immediate relevance in this context and should thus be encouraged further.

Applications as a stimulus to the development of software products development

11. The key issue in the development of software products is a demand for computer applications. Country-specific strategies for software industry development, including software applications in non-electronic industries and services, such as cement, fertilizers, agriculture, chemicals and transportation have to be developed to accommodate the mix of infrastructure, policy-framework and manpower availability peculiar to each developing country.

12. In order to improve product quality and effectiveness in the small and medium-scale industry sector, particular emphasis should be given to demonstration projects for that sector. Demonstration projects yielding tangible and measurable improvements in productivity in various sectors of the economy are of vital importance to opinion building among planners, economists and administrators in developing countries.

13. Developing countries should recognize 'value-addition' as a valid objective for the software industry. Contract programming, custom design and implementation would help build up a critical mass of experience. It

is also important for developing countries to acquire expertise in leading-edge aspects of software technology.

14. Developing countries should also consider adopting a coherent and co-operative strategy in the area of software protection along the lines already adopted for integrated circuits.

15. A large proportion of applications, especially in the small- and medium scale industry sector, could be implemented using small computers. Every effort should then be made to ensure that industrial users in developing countries are fully aware.

Networking and centres

16. There is a clearly perceived need for centres of excellence in software production and applications. UNIDO should encourage and support developing countries in setting up microprocessor and/or software applications development centres to address applications in domestic industry and develop new, intelligent products.

17. UNIDO should also lend infrastructural and related support to developing countries in setting up software development parks where professional entrepreneurs can set up operations serving both domestic and export markets.

18. UNIDO should work out methods for effectively interfacing the research results and practical industrial use. Both centres and networking could be so organized as to bring about the effective industrial application of research results.

19. The group agreed that e-mail could contribute substantially to development. Developing countries should be made increasingly aware of the benefits offered by e-mail.

Building skills

20. The most critical input to software development is the quality of the human resource capabilities available. Consequently, in order to build up the software industry in developing countries, it would be necessary to build up human capabilities in the field of software technology in two specific groups:

(i) Training those about to enter the software development industry; and

(ii) Retraining and/or upgrading the skills of professionals already active in the industry.

It is recommended that for the first group, UNIDO should provide assistance to programmes designed to ensure the cost-effectiveness and relevance of training programmes to industry. With respect to the second group, UNIDO should support countries in setting up programmes designed to acquire, analyze, adapt and disseminate relevant technical information to software developers, as well as to analyze the structural or organizational implications of informatics in both an industrial and administrative environment.

Regional and international co-operation

21. The Meeting emphasized the importance of supporting the growth of the software industry in developing countries and the pursuance of active policies to promote the diffusion of informatics, particularly among small and medium-scale enterprises. In that regard, the Group recommended that the implementation of the second phase of the REMLAC project (DP/RLA/86/003) be secured by obtaining the requisite support from UNDP and other sources.

22. The Group also recommended that drawing on the results and pilot experiences of the REMLAC project, the possibility of designing and implementing similar projects in Western Asia and other regions be explored. In the case of Western Asia, co-operation with ESCWA was recommended.

23. It was felt that lack of confidence in the quality of software products originating from developing countries was one of the major obstacles to the effective dissemination of those products. It was recommended that UNIDO should assist in the establishment of software accreditation bodies at the national and/or regional levels.

24. UNIDO should strengthen co-operation in the field of informatics between the International Centre for Science and High Technology at Trieste and developing countries.

25. The Meeting recommended that international co-operation in the field of informatics development be encouraged amongst international organizations, in particular, between UNIDO, UNESCO and ITU, in such areas as networking, skill-building and software development centres.

26. With regard to the recommendation (E/RES/1991/71) of the First (Economic) Committee on International Co-operation in the field of Informatics and to the Report of the First (Economic) Committee (E/1990/110) concerning the use of the existing co-ordinating mechanisms between UNESCO, ITU and UNIDO, in order to promote informatics in developing countries, the Meeting of the Consultative Group on Informatics Technology for Development recommended the consideration by the three organizations of a pilot project for one of the regions. The project would aim to study the possibility of establishing a regional network using a multimedia approach for education as well as upgrading industrial manpower in utilization of new technologies.

27. The Meeting further recommended that UNIDO takes necessary action for co-ordination.

III. PRESENTATION BY PARTICIPANTS

28. Short papers giving a brief account of ongoing or planned software developments, the background to the methodologies chosen, the future goals and long-term objectives were presented or made available by the invited participants. The experts from UN agencies and industrialized countries presented statements on current trends in software. Participants from

developing countries outlined their priority needs in the area of software and informatics technology. The UNIDO Secretariat presented an issue paper and provided experts' reports (see Annex 2).

29. With a view to expanding the UNIDO programme in informatics technology in line with its potential and implications for developing countries in future years, the Secretariat presented an issue paper outlining some of the considerations the Meeting should take into account when recommending the main elements of that programme.

30. The Meeting identified the content and modalities of a possible framework for action in the field of software production and application. Within that framework there could be:

(a) A set of Government policies for development of an endogenous capability in this field:

(b) Specific programmes of action, such as in the field of human resource development and other relevant areas, preferably in the form of a plan of action to be implemented by the concerned agencies and institutions;

(c) Possible institutional arrangements for developing endogenous capability such as associations of software producers or a centre for software application to industry.

31. In the scope of international co-operation, UNIDO provides technical assistance and advisory services for the establishment of software production enterprises and associations and the development of human and institutional capabilities, in particular for application of software to industry. Applied research and development of software related to microelectronics and its applications may be the subject of co-operation. In the field of public domain software, UNIDO promotes exchange of information among Member States and provides advisory services as required. UNIDO also provides advisory services for policy formulation, if requested, including the preparation of programmes and plans.

32. In many cases software applications brought to developing countries did not produce the expected results nor has the anticipated diffusion for development purposes been realized. Therefore the elements of UNIDO's informatics programme should identify more precisely areas and environment of industrial applications that are most crucial for development In the context of developing countries, the following applications seem to be of special importance.

(a) Software applications designed to improve the efficiency of industry;

(b) Software applications designed for small- and medium scale industry;

(c) Production of software for export.

33. It was noted that small modern computers are powerful enough to support the prevailing tasks of computerization in industry. A concentration on utilization of these computers in developing countries could, in many cases, substitute the more expensive use of mainframes.

34. Several issues concerning software production and utilization in the context of developing countries were discussed.

35. Contract programming can be an interesting activity for developing countries. It requires little capital investment, other than excellent training facilities and access to an international electronic network. There is a significant potential for co-operation between industrialized and developing countries in the field of contract programming. A major industrial company can start with small contract programming projects and can gradually build up a partnership with an organization in a developing country. There are some developing countries, notably India, who are active in the field of contract programming.

36. A small software house in a developing country, connected to one of the major international computer networks, e.g., Internet, can receive the specification and deliver products electronically. Also the interactions

between the client and the software house can be executed via e-mail so that an interactive dialogue is possible. UNIDO should promote e-mail utilization. A successful example of development of software for e-mail in a developing country (Mexico) was discussed.

37. 'Intelligent products' are products which integrate a mechanical subsystem with a computer controlled subsystem into a compact functional unit fulfilling a specific user need, e.g. an automatic scale with an integrated microcomputer to perform the calibration, the weighing and the recording function. A substantial portion of the cost in the intelligent product is in the application software development. The application software forms an integral part of the intelligent product. 'Intelligent products' designed for developing countries are essential for development.

38. Although there are many thousands of small software companies trying to establish themselves on the market, only few companies succeed. Especially in the last years the entry level to undertake such software production has risen substantially. Awareness of this fact should be emphasized.

39. Successful products address the following issues:

(a) Genuine user need;

(b) Ease of use;

(c) Documentation;

(d) Quality;

(e) Support.

There are many instances of successful software products in small specialized markets. These products are based on comprehensive application know-how in a specific area and provide an excellent service for a select customer base.

40. There are a number of risks associated with the production of software and the forming of a software industry. The awareness of some typical hazards encountered in the software field should be disseminated to software producers in developing countries.

41. Many software projects have failed because the real user needs have not been identified adequately. Establishing a stable and sufficient set of requirements for a software system is extremely difficult, but of paramount importance. Constantly changing requirements can jeopardize any software project. In the field of contract programming the requirements are delivered by the clients, so that this risk factor is avoided.

42. A software product should only be released after it has been thoroughly verified. Both, the normal functions and the exception handling sections have to be tested painstakingly. The premature release of a new software version has destroyed well-known software companies. The accreditation of software products was also discussed.

43. The expertise and capital required to market a technically excellent software product is often underestimated. This risk is avoided in contract programming and, to a certain extent, in intelligent product software, since in this field the marketing is performed via established marketing channels.

44. There is a worldwide shortage in highly qualified software personnel which is, at the same time, a chance and risk for developing countries. Starting a major software project with inexperienced and inadequately trained personnel is a sure route to disaster. Technical and management expertise are necessary to direct a successful software project.

45. Contract programming is definitely an interesting software production alternative for developing countries. It requires a well educated software workforce, access to state-of-the-art software development workstations and access to an international computer network. Since the prices of workstations have dropped drastically over the last five years, the capital investment for contract programming is relatively small. The major investment is in the educational field.

46. Besides discussion of subjects common to software and application development in developing countries, some country or region specific issues were discussed.

47. The Regional Programme on Co-operation in Informatics and Microelectronics in Latin America and the Caribbean was discussed. The programme's main goal is to reinforce existing infrastructures and capabilities to sufficiently absorb end use informatics technologies through national action and the expansion of co-operation between the countries of the region.

The Programme has been designed on the basis of priorities identified by the national informatics authorities (CALAI, November 1987) and, in various instances, by the focal points of the Regional Network for Microelectronics in the Economic Commission for Latin America (ECLA) Region (REMLAC).

The project is being implemented with the participation of 15 countries (Argentina, Brazil, Colombia, Costa Rica, Cuba, Ecuador, Guatemala, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela, and Chile and in co-operation with Bolivia) in the Latin America and Caribbean region. Much of the work of the project is being carried out by national experts from the participating countries together with the project co-ordination unit based in Buenos Aires, Argentina. The second phase of the project has been prepared recently. The main objectives of this phase are development of software production in the countries of the region as well as to develop applications of software in industry. Production of software will then be stimulated by applications and applications will be facilitated by software production. The objective gained the full support of the Meeting.

48. It was stated that, as can be seen from the Venezuelan experience, competition of products originating outside a country constitute a stimulus for introduction of modern production based on computer applications. The 'demonstration effect' of successful indigenous applications, as an example for non-computerized enterprises constitutes another mechanism for

dissemination of computer application. The second method especially should be supported by UNIDO.

49. A presentation was made on the Centre for Software Production in Cairo. The Meeting suggested that the Centre might constitute a main node for regional co-operation in informatics. Regional collaboration may profit from experience gained in implementing REMLAC co-operation. The Meeting felt that UNIDO together with ESCWA should assist in the establishment of such co-operation.

50. Similar co-operation might also be proposed for the Asia and Pacific region. The Indian experience in software production which was presented and discussed in detail constitutes a sound basis of such regional co-operation.

51. The pilot project aimed at strengthening software industry in Trinidad and Tobago was presented followed by an in-depth discourse. The Meeting recognized that the cost of upgrading software production has increased dramatically in the past years. It was therefore suggested that budgets for projects of this nature should not be less than half a million US dollars. This estimate is fully supported by findings in the Indian experience where software production in collaboration with a partner from an industrialized country has been successfully concluded along the same lines as suggested by UNIDO's approach.

52. It can be concluded from the Mexican experience that there is an urgent need to assist selected developing countries in advanced informatics, e.g., knowledge-based systems, neural networks, etc. Following deliberations, the Meeting encouraged UNIDO to assist such development in selected countries where there is an actual requirement for such development and for qualified manpower.

53. A presentation was made on potential computer applications in the African region. There is an urgent need to implement regional co-operation in line with the project prepared by UNIDO. The 'demonstration effect' should multiply computer applications in the region.

54. Activities in the field of informatics by ITU and UNESCO were presented and forms of collaboration with UNIDO proposed.

55. All issues agreed on regarding the discussions are documented in the chapter 'Conclusions and Recommendations' of this Report.

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ANNEX 1

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INFORMATICS TECHNOLOGY FOR DEVELOPMENT

Vienna, Austria
26-28 November 1991

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ANNEX 2

MEETING OF THE CONSULTATIVE GROUP ON INFORMATICS TECHNOLOGY FOR DEVELOPMENT

Vienna, Austria

26-28 November 1991

LIST OF DOCUMENTS

Provisional Work Programme

Provisional List of Participants

Provisional List of Documents

Aide-Mémoire

'Notes on an International Programme for Software Development and the Role of UNIDO'
by the UNIDO Secretariat

'Emerging Issues in the Selection and Distribution of Public Domain Software for Developing Countries' by Antonio Botelho

'A Strategy for the Diffusion of Public Domain Software in Sub-Saharan Africa' by Antonio Botelho

'A Study on Software Production and System Implementation by Vendors in Developing Countries linked through Remote Communication Facilities to Computer Facilities of Clients in Industrialized Countries'
by a UNIDO consultant

'Chances and Issues in Software Production in Developing Countries'
by Hermann Kopetz

'Recent Trends in Contractual Practice relating to Acquisition of Software in the United States of America and the EEC'
by Stanislaw Soltysinski

'The Potential Role of Software in Enhancing the Competitiveness of Developing Country Firms'
by Atul Wad