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ABSTRACT

Adapting of computers in less developed countries will soon lead to more advanced applications, necessitating the development of computer application science in these countries. Two examples motivating this need are given. The present international cooperation in computer science is briefly presented, and the way of its future extension, supported by the United Nations is proposed. (Author)

ADAPTING OF COMPUTERS AND THE COMPUTER SCIENCE*/

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Summary

Adapting of computers in less developed countries will soon lead to more advanced applications, necessitating the development of computer application science in these countries. Two examples motivating this need are given. The present international cooperation in computer science is briefly presented, and the way of its future extension, supported by UNO, is proposed.

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Introduction

A transfer of modern, industrial technology to less advanced countries can be often limited to a transfer of licences, thus to a delivery of devices with instructions for their use. In such a case the role of a country purchasing a licence may be passive in the sense that no creative scientific or technical effort would be needed.

Computer manufacturing by licence may be an example of such a technology. However, in the case of computer applications, apart of initial and primitive ones, the matter changes essentially, and an adapting of even generally known methods to local conditions almost always requires a certain creative effort. This is very important in view of the well known fact that the cost of developing an application system often exceeds the cost of the computer itself. In consequence, the adapting of computer technology would require an active cooperation of each country and an employment of its most qualified specialists and scientists.

Therefore, as the proposed activity of UNO considers future advantages of nov less developed countries, the accepted program of computer technology transfer should procede along with a development of computer application science in these countries.

2. Computer application today and tomorrow

The future application of computers would lead to great changes in our life, often called the computer revolution.

At present, in more advanced countries, the use of computers often happens to be an indispensable component of many scientific, industrial or economic organizations. In the future, computers will be used directly by an increasing number of people. It is presumed, for example, that the majority of private flats will be equiped with terminals connected with a proper computer network rendering subscribed services, similar to the present telephone arrangement. These terminals will be provided with TV screens and other devices enabling man - computer and vice versa communication*/.

Many examples of computer services, using such systems, may be given. One of the most important services will be rendered within the field of education. The system of teaching can consist in transfering by a computer of materials needed for learning, and next in questioning the pupil so as to check the knowledge he has gained. The computer corrects wrong answers and repeats the material the pupil is not sufficiently familiar with. So the method consists in a constant computer - pupil dialogue making the process of teaching very efficient, and every pupil can be tought individually by a computer at his own home terminal. Advanced experiments in this field are being made, and there is no doubt that computer aided education will be wide-spread in the future. With such a system the future generations will deal with com-

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*/ In the so-called time sharing system services will be rendered to every user separately, as if he had a computer of his own, although one computer serves many users simultaneously.

puters since their childhood.

The time of computer revolution may be estimated not always alike. Nevertheless, this problem should be kept in mind while planning any far-reaching international cooperation program.

3. Computer application to management problems

Nowadays most of computer applications concern management problems, also called "administrative data processing", "business application" and so on.

Initial applications in less developed countries generally concern only simple local problems of separate enterprises like pay-rolls or statistics and the adapted solutions can be rather truly copied after the patterns taken from more developed countries.

However, further considerations usually lead to the conviction that computers could be still more useful after an appropriate change of an organization of a given enterprise. Such an extended application of computers to management problems requires most often a separate study and a solution adjusted to the local economic conditions.

A still more advanced application will influence more extended organizational groups. In many countries, in particular in socialistic ones, these groups may consist of a significant part of the whole economy of the country. It is obvious that such countries must carry out such investigations within their own scope, using own specialists and own staff of scientists.

Looking for the best methods of management with the use of computers is first of all the management problem. Therefore, adapting of computers requires the development of not only strictly computer science but also of those fields of science for which the computer application is of an essential science but also of those fields of science for which the computer application is of an essential significance.

4. Future needs of local computer languages

The easiness of the computer use greatly depends on their software, and in particular on the advancement of languages in which programs and data are written.

Let us restrict the discussion to the programming languages. A big part of nowadays programs is written in higher level procedural languages like FORTRAN, ALGOL or COBOL. They are based on the accepted mathematical notation and elements of the English language, but the syntax is still primitive and the number of used words - small. A non-English speaking specialist can learn such languages relatively quick and soon get accustomed to the program in which the key-words are written in English, and other in a different language. These languages contributed very much to computer propagation among various kinds of specialists permitting them to write their own programs by themselves. Nevertheless, programming in these languages still requires a great deal of skill.

A future propagation of computers among the users with much smaller qualifications demands the programming languages to be much more similar to the natural ones. An example

of such a need may be computer aided teaching, which was already discussed. Therefore, adapting of future computer languages should take into account not only verbal but also syntax differences of natural languages, and this problem is not so easy.

It should be noted that the now developing countries would like not only adapt the languages developed elsewhere but also look for their own solutions. In both cases such a country must have to its disposal a group of its own specialists and scientists.

5. The present international cooperation in computer science

The tradition of international cooperation in the field of computers is already established. Its main factor is the activity of the International Federation of Information Processing /IFIP/ created in 1960 after the International Conference in Paris 1959 sponsored by UNESCO.

IFIP associates about 30 countries, therein all countries with advanced computer technology. The activity of IFIP is rather versatile. IFIP Congresses are organized every 3 years, presenting the review of scientific progress achieved within all more important branches of computer science. Now there are IFIP technical committees comprising a certain number of working groups. The TC-1 Committee deals with technology. The TC-2 Committee is devoted to programming languages. The TC-3 Committee is active in the field of education within the international scope. The newly organized TC-4 Committee deals with computer application to medicine.

Within the frames of IFIP there is also the Administrative Data Processing Group /IAG/ which is very active in the field of international cooperation of data processing computation centres.

Along with IFIP one should mention the activity of the International Computation Centre /ICC/ and its contribution to people education in developing countries. However, most advanced countries like USA, the Soviet Union and the United Kingdom are not the members of ICC, and therefore the scope of ICC activity is much more restricted than the one of IFIP.

Parallel to the organization of scientific cooperation, which is in principle available for every country, there are well known examples of mutual work among limited groups of countries. The cooperation of Academies of Science in socialistic countries in the computer field can be presented as such an example.

6. Extended international cooperation in computer science

The extended international cooperation in computer science should include first of all:

1. The organization of international scientific meetings over the world.
2. Creating of working groups to solve scientific problems of international importance, e.g. elaboration of principles of international exchange of various kind of information by means of computers.
3. Research scholarships, sending visiting professors and scientists to help less developed countries.

4. Organizing courses for young workers in less developed countries.
5. Financial help and consultations while organizing regional or national computer research centres.
6. Creating an international centre of information exchange among scientific centres.

The majority of the above undertakings should be combined with a wide-spread education of specialists and personnel training in the field of computer applications.

7. Organizational forms proposed

In order to reach the above mentioned aims one should first of all extend the activity of many existing scientific international organizations which ought to be supported by UNO. In particular the possibilities of IFIP and those of the family of national societies represented by IFIP should be used. The extension of ICC activity should be also considered under the condition that a bigger number of countries would join this organization.

Within the frames of UNO many of its organizations and commissions should be involved, having their own program of activity in transfering computer technology to less advanced countries. An especially important role should be played by:

a. UN Educational, Scientific and Cultural Organization /UNESCO/, which should take special care of organizations dealing with international scientific cooperation in computer field.
b. UN Development Program /UNDP/ should finance and support the organization of national computer re-

search centres, scholarships, experts' services and so on.

To coordinate the entire activity of UNO in the transfer of computer technology, a special council to the Secretary General should be organized, associating representatives from various countries. This Council should collaborate and be supported by the staff of the UN Office for Science and Technology.

While considering the role of UNO, an international computer agency, similar to the International Atomic Energy Agency /IAEA/, might be discussed. However, I believe this idea would not be the best for the time being. Many arguments which made up to create IAEA cannot be applied to the case of computers which e.g. do not require an international control as far as health and safety are concerned. Besides, such an agency would require additional costs and efforts.

8. Conclusions

In order to achieve a full use of computer technology, less advanced countries must develop the computer application science on the spot. This problem should be introduced in the now prepared report of the UN Secretary General. I would like to suggest the following supplements to the "Transfer of Computer Technology", as presented in the Outline of June 16, 1969.

Point 1.2. /Summary of recommendations/ should include recommendations on computer application science.

In chapter 2 /Computers and Technology/ there should be a point treating future influence of computers upon the community /computer revolution/.

Point 2.3. should comprise the computer science as well as technology.

Chapter 4 /development program/ should include a special point devoted to international scientific cooperation.

The Resolution accepted by the General Assembly /2458-XXIII/ usually treats the science and the technology jointly, which, in my opinion, should be reflected in the Secretary General Report.

Warsaw, September, 1969