PERSPECTIVE OF POLICY DEVELOPMENT IN THE FIELD OF INFORMATICS: THE EXAMPLE OF VIDEOTEX TECHNOLOGY

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PREFACE

This paper was presented at the Informatics Session of the International Information Industry Conference which was held in Quebec City between June 1-3. The paper represents the general view of the author on the important public policy issues raised by the emerging information society. It shows how the information society comes about in countries with different development status and policies, and those areas where future research is needed.

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From the Technological Point of View: it can be done

"The Information Society is just around the corner" -- is the essence of numerous studies and papers appearing in the press, many of them, for example, claiming that the role of printing is changing and that our society is witnessing the emergence of the so-called "Electronic Publishing Industry". The fact that all these studies and papers still come out in printed form, using the good old paper printing technology, seems to be a bit contradictory and controversial; but all in all it can be claimed -- and we should accept here and now the following general statement -- that from the technological point of view all the preconditions can be fulfilled to build up an information based and dominated society, and this within a reasonable time horizon -- at least in the most developed countries.

The Time-Lag

There is no doubt that the impact of the microelectronic revolution is being felt first in the most developed countries, but there can be no doubt either that this technology will in an increasing manner also penetrate the medium to less developed countries. This -- and here one has to be realistic -- would occur with a certain time delay, as with any previous industrial technology. An example is the steel industry, where the actual time lag between penetration in the most industrialized and the developing countries was about a hundred years. This delay is important as it now creates serious production, marketing, and sales problems for many highly industrialized countries, such as West Germany, the United Kingdom, or even the US.

In the case of microelectronics and the new information technologies it is desirable to minimize, or better to optimize, the time-lag, a term often confused in my view with "technology gap". As to the speed of technology penetration, it is well known that the growth figures for the microelectronic and new information technologies -- both for the most developed and less developed countries -- far exceed the figures for any other technologies. It is quite clear also that, in the course of development, the most developed countries are about to arrive at a turning point, where microelectronics and the new information technologies will significantly influence daily life. Let us call this turning point the beginning of the "information society". If the most developed countries do well and manage to keep a good control over the technology -- which I believe they can and will -- they will have the privilege to enjoy first the fruits or the curses of the new "information society".

Another Society with a Janus-Face?

The information society will offer many new challenges and opportunities, but I also believe, if not managed well it might cause much damage to people and society. Think only about the tremendous opportunity of microelecronics and new information technologies in military applications: cheap, mass produced super-intelligent microprocessors applied to missile and torpedo control; sophisticated image analyzing and processing methods for handling information provided by remote sensing military satellites; complex cryptography systems built on new information technologies for military purposes -- only to mention a few.

The Employment Issue

The impact of the microelectronic and new information technology revolution on employment is not clearly and satisfactorily answered yet, and it is in my opinion an open question as to what society will do about those people who are going to lose their jobs. The usual response to this point is that in previous societies, such as in the agricultural society when agriculture became industrialized, ample opportunity was provided by the emerging industrial society i.e., job opportunities in the industry. Later, when mass production was introduced more and more into industry, the third, so-called service-type, occupations were developed, which significantly contributed to the provision of a sufficient number of job opportunities. During the last couple of years, there has been much discussion of whether besides agriculture, industry, and services there is also a fourth economic sector -- the so-called "information sector" -- which includes all activities and industries that are linked to information production, information procession, information distribution, and the provision of an information infrastructure. Several studies have shown -- some of them triggered off by the OECD [2] -- that in the most developed countries the information sector has become or soon will become the leading employer (Figures 1 and 2).

According to Figures 2 and 3, however, there seems to be a non-negligible time-lag, even for the most developed countries (cf. 25 years for the USA and Japan). Unfortunately no equivalent curves are known for the developing world yet, but it can be assumed that the time-lag is tremendous. The similar behavior of the employment growth curves for

the information sector suggests that their relatively slow growth pattern will be true for the rest of the world. The reasons for this are surely not only technological but also economical, cultural, and labor aspects.

There is,however, still a strong fear that if the information society is coming about -- which as I mentioned at the beginning is just (but still) "around the corner" -- this might have a serious impact on the present employment pattern.

The industry sector could be seriously affected by the penetration of robots in manufacturing, parts of the service sector could be affected as well (e.g., the increasing replacement of transport by communication); and the information sector itself could be seriously affected (e.g., the lower staffing requirements of a "perfect" electronic office). Where could all these jobs move to?

It is said that to a great extent they could be absorbed by the information sector. But is it really certain that the information sector can offer more new jobs than are being lost from all sectors? Is our society well prepared to take over such jobs?

The Zero Economic Sector

Although many authors only speak about four economic sectors, in my view, a new one -- the unemployment or zero sector -- should also be introduced. It is this non-productive but still consumptive sector that causes most problems in any society, although it should not be blamed for that. In Figure 1 we have also included the curve of the zero sector as percentage of the total working population. Whenever the curve goes up -- even for relatively short periods -- the society usually comes to a serious crisis. What has to be avoided under any circumstances is that the unemployment sector reaches a new "breaking point" in the information society. I personally do not see the emergence of a new, "fifth economic sector", which could absorb unemployment if the information sector seriously affected jobs. As an alternative, we should certainly consider reducing working time while keeping full employment. But what is a reasonable lower limit for weekly working time?

Computer Illiterates in the Information Society?

The next major question: has or will our society have received an adequate education for a future information society? If the most developed countries are certain that from the technological point of view they will be able to provide a solid basis for the information society within the next decades, then do they already take into consideration that the present upgrowing new generation has to live and work in this new type of society? I think the answer to this last question is a clear "No". Thus, what is going to happen with the majority of the present and "near future" working generation, which is clearly "illiterate" in the "informatics" disciplines? Can an information society be built on a working population with the given structure and skills? The clear answer, I think again is "No", and I must say that the present or "near future" working population cannot be blamed for the fact that they are illiterate in "informatics" disciplines, and that they lack the skills that are needed in an information society. On this point, certainly, governmental action is required.

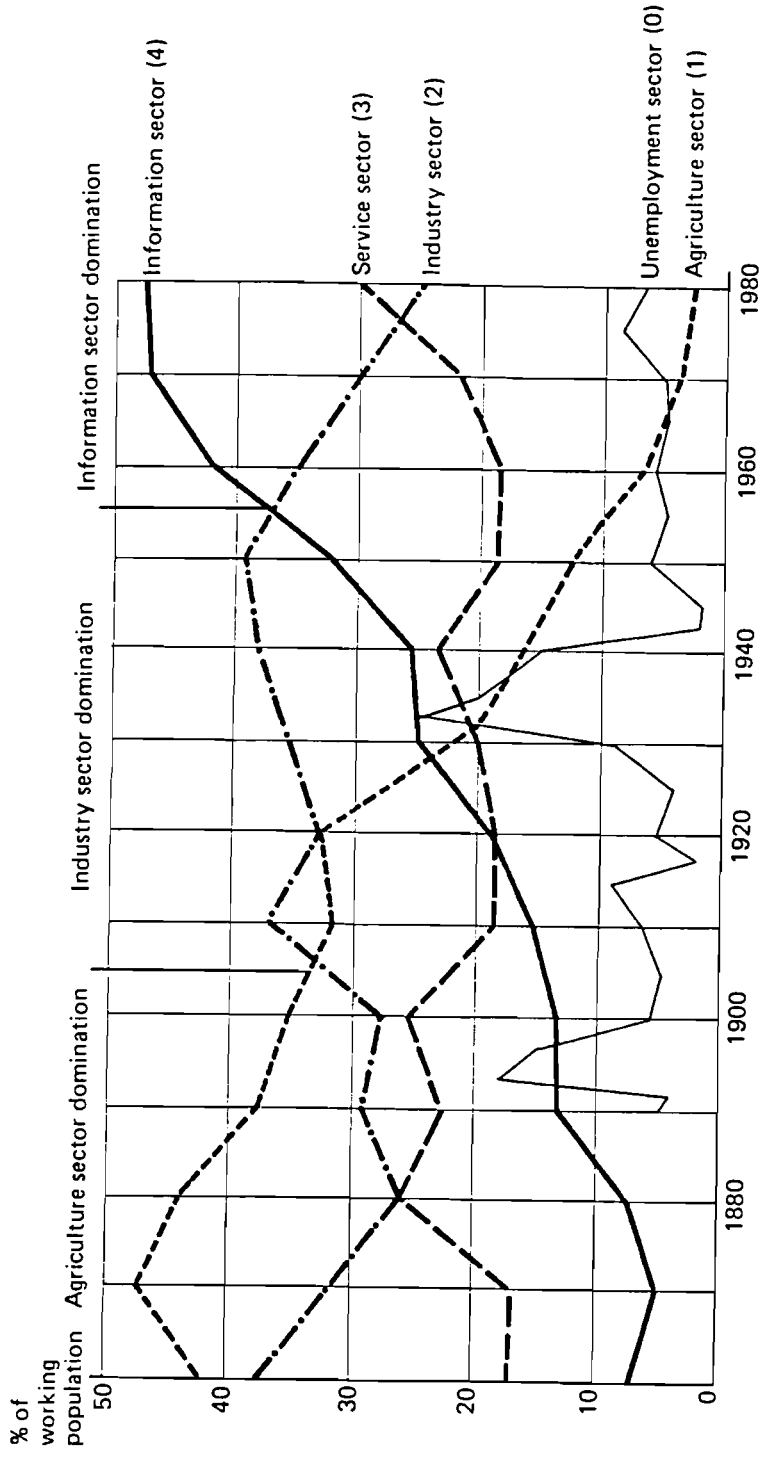


FIGURE 1. Employment in the four productive economic sectors and the unemployment sector in the USA between 1860 and 1980 (data taken from [1, 4, 5]).

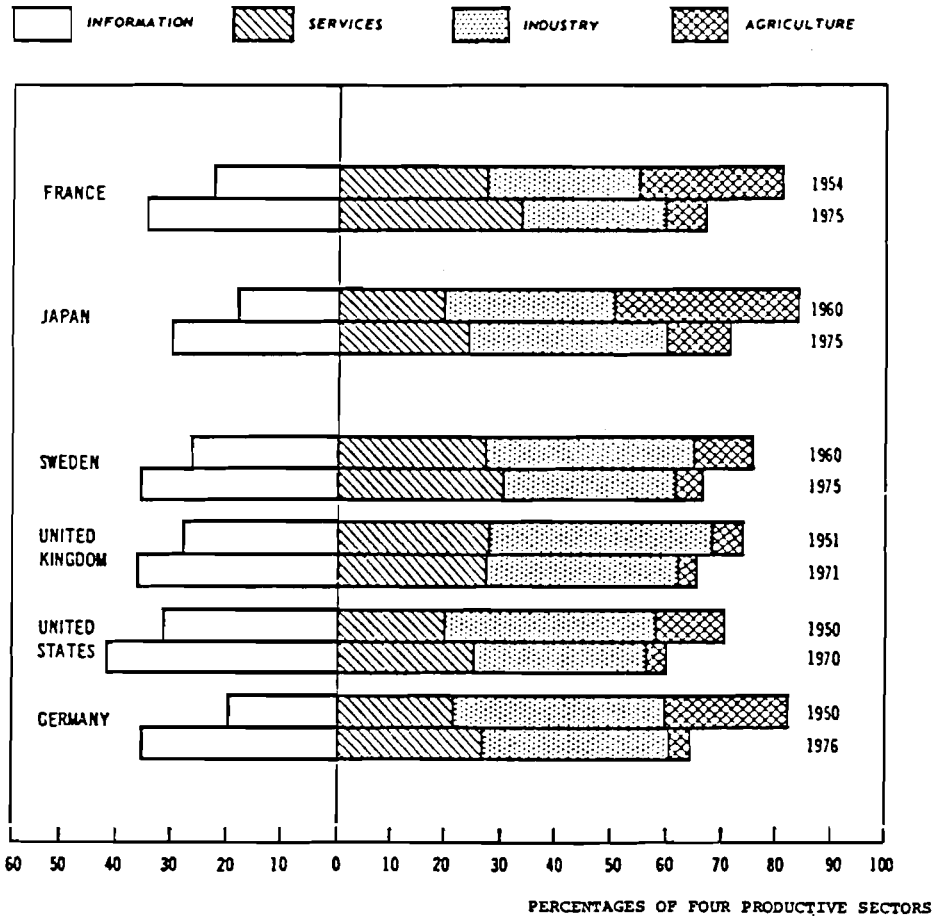
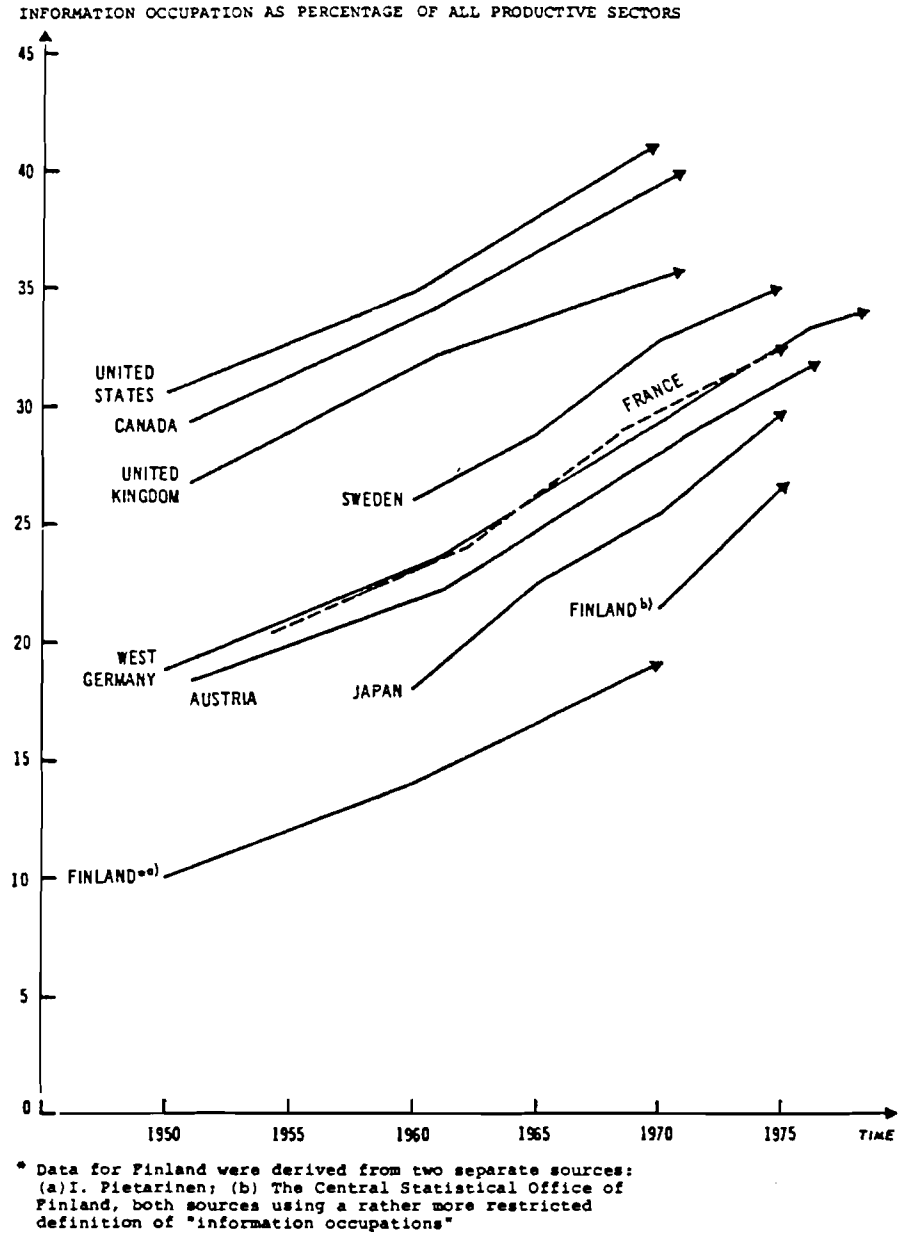


FIGURE 2. Four productive sector aggregations [2].



* Data for Finland were derived from two separate sources: (a) I. Pietarinen; (b) The Central Statistical Office of Finland, both sources using a rather more restricted definition of "information occupations"

FIGURE 3. Changes in the share of "information occupations" in all productive sectors over the postwar period [2].

The Wealth-Creating Information Society

Let us now turn to the potential positive effects of an information society, which in my opinion are still as "unclear" as the negative effects, but which are at least promising. Historically, in each type of society there were factors that one could call "wealth-creating". In an industrial society, for example, mass manufacturing and also mass consumption were regarded, among others, as such "wealth-creating" factors. But what will be the wealth-creating factor in an information society? I do not know, but I believe that the information society could provide those tools -- and this could be regarded as one of the wealth-creating factors of the information society -- that might help to resolve some of the major problems of our present society. I think one of the biggest problems that the present industrial societies face (and on this point there is no difference between "capitalist" and "communist" ideologies), is that no single ideology takes properly into account the fact that our world has several limits: first of all physicall, geographical limits; then limits on resources; limits to the earth's resilience (see environmental problems and resilience of nature); and limits on population (see food and urbanizational problems). We recognized these problems more than a decade ago, but we have not come any closer to solving them. Energy is still a scare resource and is becoming more and more expensive, and probably has to be. The environmental quality of the earth has gradually worsened (e.g., nowadays all better hotels in the Caribbean and on the coast of Florida offer to their clients the "excellent" services of their "tar stations" after swimming, or in West Germany and Austria seemingly nothing can stop the dying out of pine forests due to acid rain damage). The problem of hunger in the developing world can also not be solved. It seems as though the classical type of industrialization is gradually destroying the earth's environment. For this reason industrial countries probably have to change their industrial strategies and the developing countries probably have to aim at new industrial strategies, which are less energy and resource consuming, pollute the environment less, but provide enough job opportunities.

I do believe that the above mentioned revolution in microelectronics and new information technologies will provide global tools to manage and better control the use of energy and other natural resources, will lead to the use of methods and technologies that will reduce the pollution of the environment, and yet better satisfy basic human needs. For example, I believe that communication could gradually substitute transport where it is possible; commuting to work or business visits by whatever means of transport, which is not only consuming time and energy but also contributes considerably to the pollution of the environment, could be reduced by "teleworking" and "teleconferencing", supported by new telecommunication and computerization services. "Electronic publishing" and the "paperless office" -- which will come about gradually and only to a limited extent – will have definite impacts on the paper and forest industries that are positive from an environmental point of view. I believe, thus, that the information society will bring along those opportunities and chances that can help to solve the current serious world problems. It is up to our society to take advantage of these opportunities. As we see the world today, not too many chances will be given to mankind during the next decade to come; therefore it is of the upmost importance that the

chances provided by the information society should not be missed.

Transborder Data Flows

The nature of transborder data flow problems -- in my view -- is going to change in the coming years. The "technological basis" of the present transborder data flow discussion still assumes the technology of the seventies, which was based on the potential of massive concentration and the centralization of data and processing power, with "electronic" or "physical" delivery of information. The technology of the eighties, however, is bringing basically new elements into the picture, which can be characterized by decentralization and distribution of data and processing power at the user's site. In addition the cost and penetration of the telecommunication component needed is considerably slower than of data handling and processing components. This means in the longer run that the nature of transborder data flow will be basically either "real transaction" (such as messaging sending, financial transactions, or travel reservations) or the bulk exchange and transfer of data to be stored and processed locally. By that time some of the present problems in this field -- such as access to public databases in foreign countries or databases stored in foreign countries -- will most likely have disappeared. However, new problems, mainly due to the penetration of the information and telecommunication technologies, into daily life, can be expected.

The "time-lag" between the developed and developing world will always create some problems in transborder data flows; nevertheless, the world must find a new transborder data flow order, which satisfies all parties to the maximum extent possible yet involves least costs and risks.

National Data Flows

The emerging information society will bring about many new internal policy issues for a given country. The new information and telecommunication technologies -- as flexibles tools -- allow both increased centralization of control and decision -- taking by governments as well as mass distribution of the same control and decision process. Each country has to find the right balance between the two extremes, which is best adjusted to its national environment. Issues such as privacy and teledemocracy also fall into this category.

Vulnerability

Much discussion is going on about vulnerability of a computerized society. As with any society the information society will be vulnerable to a certain degree ("life is dangerous"). The basic question is how to "design" and "implement" an information society in which the vulnerability of the new society is reduced to an acceptable level of risk -- and this at acceptable costs -- while preserving all its advantages. Assessing the risks before "design" and after putting into "operation" will always be a key issue in order to allow adjustments.

My answer to the question whether the elements (hardware, software, data, manpower) of an information society are of strategic importance to a given country -- keeping in mind the present political situation of the world -- is unfortunately "yes". This reduces the possibility of resource

and labor sharing between nations, reduces the advantages of the economies of scale, reduces the possibilities of cooperation and also the possibility that nations get to know each other better.

Nevertheless, a correct balance between national security and cooperation has to be achieved.

In my view much research has still to be done on the vulnerability issue, but in principle I do not see any reason why a properly designed information society should not work.

Technology is not Everything

To take the right steps and decisions when necessary, however, requires a the full understanding of the issues in a future information society, and as mentioned in this field much research still has to be done.

The center of our present studies is still mainly around the technology of the future information society. And this is understandable,because first the technology has to be understood and solved and only then can assessments be made about what the economical, labor, political, cultural, etc., impacts of this new technology will be. Moreover, our present society is still very much technology driven and the major interest of the industry -- one of the major driving forces in research -- is and perhaps has to be technology oriented. Therefore, the focus of most of the present studies is still the technology: what can be done, how can it be done and at what costs and profits, on what time horizon, and finally is there any market for it? The answers to these questions are not easy to find: this is one of the reasons why it keeps our research potential so occupied. But while studying the technology and the economics of a future information society one should not forget the wide range of other aspects -- such as labor, quality of life, culture or politics -- on which the technology and economics of a future information society might have a serious impact. These must also be looked at seriously.

The Videotex Example

Our studies at the International Institute for Applied Systems Analysis have so far focused primarily on the technology and economics: we have studied and analyzed some of the new microelectronics applications and new information technologies that we believe will create the basis of the future information society. We have carried out studies on subjects such as computer networks, videotex and teletext systems, office automation and video discs to mention but a few. To give a typical example of a study done by our institute, we have presented a a background paper to this conference, the IIASA study "One-Way Versus Two-Way Videotex" [3].

As it is known the basic idea of videotex is to add sufficient electronics to TV sets so that they can be used not only receiving TV programs but also as terminals of a computer supported information and transaction on system. Videotex came along in two varieties: as broadcast or one-way systems (called also teletext) and as interactive or two-way systems (called also viewdata).

The paper describes in an interdisciplinary way -- rather on the technical, economical and historical surface -- the past, present and possible future of videotex and the range of applications it might fulfill. This technology is believed to be capable of becoming an important factor in a future information society.

It became evident from the study that:

- The microelectronic and information technology components of videotex systems will not be a barrier in the market penetration process.
- The state of the telecommunications infrastructure for a given country might, however, become a barrier for future systems. Historical statistics show that the development of a fully wired telecommunications infrastructure takes considerably longer than the build-up of media based on broadcasting. Therefore, when creating national information and telecommunications policy concerning future videotex systems, these factors have to be taken into consideration. Roughly speaking, one may say that for developing countries with little or no telecommunications infrastructure, it is better to put as much videotex service on the broadcast media as possible. For the developed countries with congested broadcast frequencies and well developed terrestrial infrastructures it is preferable to put full channel teletext and interactive videotext on cable TV, the telephone, and the national packet-switching network.
- It can be expected that the penetration of videotex will take decades and will certainly be slower than either radio or TV.
- Factors such as governmental information and telecommunications policy ("subsidize or not subsidize videotex, back it or not") will be of decisive importance.
- For this and other reasons we believe that it is most complex and difficult to predict the path of the videotex penetration. As to other kind of barriers, such as organizational, legal, and human aspects of videotex penetration, further studies have to be undertaken.
- For the Industry the mass application of information and telecommunication technology will open new opportunities, similar to the process that happened in the automative industry after the introduction of the "model T-Ford" concept at the beginning of the century.
- It is believed that videotex systems will play a significant role in a future information-oriented society and it is hoped that they will assist in overcoming some presently unsolved problems of society, such as the previously mentioned scarcity of energy and mineral resources, environmental pollution, urbanization problems, problems of food supply and industrialization, and finally that they will improve the quality of life.

- One of the major conclusions that can be drawn from the study is that there is no single governmental information policy on videotex; these policies may have and probably have to differ from country to country and they also may be different in the same country at different times.
- Videotex actually offers different opportunities to different countries and herein lies its chance.

  In the most developed countries it will enable the mass penetration of the new information and telecommunication culture, in the less developed and developing countries -- due to its simplicity and its relative cheapness -- it will offer real opportunities to lay the basis for a "computer-culture".

The Time-lag – an opportunity?

Returning to the above-mentioned long "time-lag" between the most developed countries and the rest of the world it seems to be neither realistic nor desirable that the growth rates in the rest of the world in general can and should be significantly increased in order to catch-up the most developed countries within the next ten years or so (countries where practically nothing has been done so far are obviously excluded from this statement). There should be a limit in growth rates not only because of technological but also because of economical, labor, cultural and political reasons. It is my feeling that it is not worthwhile to force the pace of growth beyond a certain point, because the benefits obtained will not be in proportion to the magnitude of the efforts. It can be assumed that the -- not overforced -- but still high growth rates in the medium and less developed countries will also cause enough "infantile disorders", which have to be overcome one by one.

Nonetheless, because of this time-lag there still can and will be a forum and space for any cooperation in the field of microelectronics and information/telecommunication technologies between the two worlds; in a form of collaboration in which both sides can reap major benefits. For the developing countries the opportunity of collaborating among each other – due to having the same development level -- will be enormous.

And last but not least – thanks to the time-lag -- there will be one advantage for the medium and less developing countries: the information society with its "blossoms" and "thorns" will first come about in the most developed countries and affect them. The most developed countries have no other choice but to take the risk. The role of an "observer" in this process is not necessarily an unpleasant one, since one can learn without paying the tuition fee. In this respect the disadvantage of being less developed can be turned into a chance. I hope that at that time the right lessons will be learned and only those elements will be taken over in the "information society" of the medium and less developed countries that will be for their prosperity.

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