The social implications of the use of computers across national boundaries

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Large time sharing systems and distributed networks of computers are already major factors in tying together decentralized national operations in both the public and the private sectors. In the public sector, the marriage of computers and communications is apparent in such systems as the ARPA Network, the Air Defense System, law enforcement systems, weather forecasting and the like. In the private sector, there are many such systems used for tying together sales offices and warehouses or ticket offices and data banks of reservations systems, as well as serving various other scheduling, financial control or logistics operations in large corporations. In fact, discussions on the design and development of massive national or regional information utilities have been appearing with increasing frequency of late.¹

In light of these developments it appears to be only a matter of time before these kinds of computers and communication networks are in widespread use across national boundaries. In fact, as will be briefly discussed in this paper, a small number of such systems are already in use in multinational organizations and many more are being contemplated. But while the national use of computer networks is just a logical extension of current trends and capabilities, the multinational use opens a whole new realm of considerations in the technical, as well as the social, political and economic spheres. These issues have not yet even been identified, let alone explored or addressed in any meaningful way.

In order to begin an inquiry in this area, the Social Implications Committee of AFIPS sponsored a year-long Delphi study at the Center for Futures Research of the University of Southern California. Some of the major findings of the study, which was completed in February, 1973 are summarized in this paper.

PROBLEM AND METHODOLOGY

The use of computers across national boundaries can take many forms. We will use the designation “multinational computer system” (hereinafter abbreviated as MNCS) to mean any arrangement whereby computers in one country are directly linked to other computers, data bases, or computer users in one or more other countries. The use of computers in this manner at the present time is certainly not widespread. However, as one projects ahead ten to twenty years and contemplates on the one hand, the rising tide of multinationalism in both corporations and governmental organizations, and on the other hand, the rapid increase in capabilities and decrease in cost of computers/communications networks, one can conjecture that it is only a matter of time (and probably not very much time) when these kinds of applications will proliferate. To help understand how such systems can be employed effectively, a brief look at the literature describing current applications might be instructive.

In the public sector, one of the most dramatic uses of computers across national boundaries is in connection with the United States space program. NASA’s Apollo Program, for example, employs a real time international (indeed, interterrestrial) network composed of computers linked to monitoring stations to provide instantaneous data for real time decision-making with regard to the landing of astronauts on the moon. A space ship on the moon may be the world’s most remote terminal allowing man to interact with a central computer in a real time mode. NASA also uses a system called the Computer Assisted Network Scheduling System (CANS) to produce, modify and observe actual and simulated schedules for space flights tying together stations and equipment in a
worldwide network. In addition, NASA's RECON System is an excellent example of a multinational on-line information utility. The network consists of a central computer facility in Germany linked to terminals in the Netherlands, Sweden and France for the purpose of permitting research users to operate in an on-line mode through access to a large collection of scientific and technical literature.

The RECON System has served as a model to stimulate researchers to suggest that the United Nations sponsor a world science information system as a mechanism for permitting nations, universities and professional associations to share scientific information more effectively and avoid needless duplication of efforts. Most nations still have a proprietary policy regarding the flow of scientific information across national boundaries. For this reason, UNISIST (the U.N. acronym for the World Science Information System) does not envision a world system in the sense of a preplanned, integrated organization under a single manager; instead, UNISIST hopes to operationalize a flexible network of cooperating services among quasi-independent systems. The end goal technically of UNISIST is to have centralized processing of information, probably on a regional basis, so that users will have information available to them across national boundaries in an on-line time-sharing basis with display of information virtually anywhere via remote terminals. Part of the system would be a world register of scientific periodicals. At the Intergovernmental Conference for the Establishment of a World Science Information System, held at UNESCO House in Paris in October, 1971, the Conference recommended that the Director General of UNESCO take steps to make adequate budgetary provisions available in order to implement the first stages of UNISIST during the fiscal period 1973-74.

In addition to UNISIST, the United Nations is currently in the process of establishing its international computer center in Geneva, Switzerland to serve as a centralized computer facility for all U.N. organizations, wherever they are located. The center contemplates being on-line to other U.N. centers around the world, serving such users as the U.N. Development Program and the World Health Organization, with an ability to develop and maintain international data banks containing inventories of economic and social statistics, and to develop multinational management information systems for use within the United Nations.

There are other public applications of MNCS as well. The World Meteorological Organization employs a worldwide computer network in its World Weather Watch program for monitoring and forecasting weather conditions at the global level. The banking community represents another example. Most central banks are government run and are rapidly increasing their use of on-line computer services tying together remote branches. It is expected that by the late '70s, most central banks will be transferring funds and carrying out the bulk of foreign exchange operations via international computer networks linking chains of large multinational banks to create a global service industry in banking. Finally, in passing, we must at least mention the many multinational military uses of computers which have provided much of the technology that will be applied in non-military applications.

In the private sector, there are also numerous existing applications of the use of computers across national boundaries. The major international airlines and some travel agencies already have multinational reservations systems covering many activities. For example, International Reservations, Limited has a multinational real time booking service to confirm reservations for hotels, motels and car rentals with a central computer center in Virginia linked to remote terminals in the United States, Great Britain, Switzerland and Ireland. The American Express computer network also is a worldwide system with links to remote terminals for reservations purposes. Similarly, such airlines as the Scandinavian Airlines System, Air Canada, Yugoslav Airlines and others have multinational networks serving reservations functions as well as management reporting, statistical analysis, passenger records and other accounting functions. In fact, there is already an example of an international cooperative effort to own and operate a multinational computer network performing similar functions for a large number of users. The Societe Internationale de Telecommunications Aeronautiques (SITA) is a multinational computerized communications network owned by the airlines and serving about 130 companies.

Computer services networks for commercial purposes are relatively common within certain countries such as the United States and Great Britain but are now beginning to reach across national boundaries, particularly in Europe. For example, Honeywell, since its acquisition of General Electric's computer hardware functions, now has a vast network of on-line time sharing services. At present, Honeywell operates a European time sharing service consisting of seventeen time sharing systems covering fourteen countries from Denmark to Italy and serving more than 8,000 businessmen, engineers, scientists and students. Similarly, University Computing Company, Limited has a multinational computer utility consisting of two Univac 1108 computers in London linked to regional centers in Paris, Dusseldorf, Frankfurt, Brussels, and The Hague.

The publications and broadcasting industries have expressed considerable interest in multinational computers. For example, Triangle Publications, Inc. assembles eighty-one separate editions of TV Guide every week using its on-line computer communications system in the United States and Canada. United Press International is installing a computer based multinational news network which will link its New York headquarters to a worldwide information storage and retrieval system. Multinational stock quotations services are another example of computerized news services. Very extensive
systems are now in operation by Reuters and Ultronics linking together stock brokers in the United States, Canada, Europe, the Far East and South America.

Finally, there are several examples of multinational corporate information systems within companies but across national boundaries. For example, IBM has a system of interconnected computers which exchange engineering information among its laboratories in Europe and the United States. Ford Motor Company similarly links its British plants to facilities in Germany. Such insurance companies as the British American Insurance Company, Metropolitan Life, the Sun Life Assurance Company of Canada and others link their home offices to terminals in other countries for the purposes of transmitting policy data and other statistical transactions.

The Japanese have been very active in this area. In 1971 Mitsui installed a fully computerized global communications network linking together 115 Mitsui offices in sixty-nine countries, claiming to be the world's largest commercial computer telecommunications network. Mitsui claims that the company's management information system receives information daily, including a wide variety of environmental information regarding market conditions from all of its world-wide locations through its network.12

A number of companies have installed at least the rudiments of multinational information systems. For example, Monsanto has centralized its computer facilities in St. Louis but has tied that installation to remote facilities in the United States, Europe, and Latin America for management information system purposes.13 Gulf Oil has tied its Pittsburgh computer center to twenty-five other computers located in the United States and overseas in order to monitor and control Gulf refining and transportation operations around the world.14 Vickers International Division of Sperry Rand Corporation has a multinational inventory control system, as does Canadian Pacific Railroad and other companies.

This list of examples in the public and private sectors is far from complete. In fact, more than forty such multinational applications were discovered in the course of the brief literature search conducted for this study and there are certainly many more such applications than are reported in the literature. The point is that the multinational use of computers is no longer hypothetical; it is real and its influence is rapidly expanding. But what will its long term impact be? Nowhere in the literature is there a detailed examination of the likely future consequences of this new development. What will be the impacts upon intergovernmental relations and politics? What will be the impacts upon corporate management and operating practices? What will be the effects upon individuals and whole societies of this intimate linking together through computers and telecommunications of the peoples and nations of the world?

To begin to identify the important issues in these areas, the Social Implications Committee of AFIPS asked the authors to conduct a Delphi study of leading thinkers and researchers in related fields.15 With the assistance of AFIPS officers, an outstanding Delphi panel was assembled consisting of corporate officers, government officials and computer experts. In all, fifty-seven people participated in the process as listed in the attachment. A carefully prepared list of questions was developed from an examination of the existing literature and extensive discussions with members of the AFIPS Social Implications Committee and other computer experts. Three iterations of the Delphi questionnaire were necessary to clarify issues and to develop a preliminary understanding of the reasons for the positions that the panel took on the issues.

One word of caution is necessary before summarizing the results. The study suffers from all the limitations of the Delphi approach. Moreover, it was not intended to be a comprehensive or systematic (much less scientific) examination of the issues that can arise from the use of multinational computers. This will require a far more detailed and rigorous study than was possible here. The only intent was to have one particular panel help us to define issues so that the professional community would have some guidance as to where to look further in assessing potential impacts. Since the panel had to consist of computer-knowledgeable people, it would be surprising if the data did not reveal an optimistic bias favoring the spread of computer usage. Thus, the reader is cautioned not to consider the data presented here as predictions, but rather simply as the first crude attempt to define a new field of inquiry.

The results will be discussed under five headings which correspond to the five major areas of inquiry of the study. They are: technological aspects, socio-cultural implications, public policy and administration, multinational business implications, and impacts on the developing countries.

TECHNOLOGICAL ASPECTS OF MULTINATIONAL COMPUTER SYSTEMS

While the study was not concerned primarily with technological dimensions of the MNCS, it was necessary to explore a few of the technical developments that would most affect its use. The entire panel agreed that it would be necessary to increase the speed and reduce the cost of transmitting data through developments in telecommunications such as the following:

1. Improved facilities, particularly satellites;
2. Better switching systems for wide band communications; and
3. Improved and more widespread use of CATV for home communications.

Similarly, 97 percent of the panel agreed that in order to utilize computers across national boundaries on a large
From the collection of the Computer History Museum (www.computerhistory.org)

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scale it would be necessary to provide improvements in portable, on-line and inexpensive terminals as well as smarter and more flexible terminals. The same percentage agreed that it will be critical to improve computer storage systems through providing cheap, high speed associative memories; faster, larger capacity and cheaper secondary multiaccess memories; and safe, inexpensive storage to replace magnetic tapes and discs. Many (92 percent) focused upon the man-machine interface suggesting that improvements were needed in interface support facilities; in cheap, high speed hard copy printers with unlimited character sets; and in more sophisticated man-machine interaction possibilities.

With regard to software, the panel felt that for the MNCS to be widely applied, international agreements on software standardization would be needed, as well as improved large scale multicomputer operating systems and improved software support for “human intellect augmentation.” The panel also agreed that cost-effectiveness improvements were required in the development of data management systems capable of handling large, decentralized multinational data bases; in automatic language translation; in automated mass education techniques and in the use of time sharing systems. However, with regard to automatic language translation, a large majority did not believe that we would see the “first practical application of voice-to-voice transmission with computerized translation and voice synthesis across the boundaries of at least five countries” until the end of this century if at all. Further, it was felt that once developed, this use of computers would likely be restricted to narrow technical domains with highly constrained query languages.

SOCIO-CULTURAL IMPLICATIONS

One of the main themes investigated in the study was that global technologies such as the MNCS have a tendency to support various forms of cultural uniformity and homogeneity. Most (75 percent) of the panel agreed with the statement that “the use of computers across national boundaries will contribute to the homogenization of cultural tastes and attitudes, although the process that each country goes through to attain this homogeneity may be different, and in some cases may lead to social upheaval.” This was further reinforced by the panel’s opinion regarding the question illustrated in Figure 1A. We must be careful about interpreting these findings however. While Country A may come to contain the same general spectrum of beliefs, behavior and values as Country B, the spectrum for both may greatly widen from that of today as technologies permit much greater diversity of life styles and actions. As one panelist pointed out, the linkage of computers and communications can individualize the mass media by permitting many more specialized messages to be sent to specialized audiences in place of a few messages sent to everyone.

On the psychological effects associated with multinational computer systems, 84 percent of the panel agreed with the statement that multinational computer systems will increase the level of fear that some people have regarding the mechanization of life they associate with all computer systems. On the other hand, as indicated in Figures 1B, 1C and 1D, the panel strongly anticipates the early use of MNCS for educational purposes, an application that might eventually go at least part way toward negating that fear. In all these questions, the panelists expect great activity in the decade between 1980 and 1990.

A somewhat less optimistic picture emerges with regard to multinational library and data bank applications, as shown in Figure 2. Many panel members felt that the use of these library networks would be so limited in the near
future, so expensive and so difficult to achieve international agreements on, that collaboration as proposed could not be foreseen before the end of the century, if then. Of course, they are more optimistic about scientific data banks (Figure 2C) because of the experience with the NASA RECON System and UNISIST, but even here, they are very sensitive to the potential economic and political barriers. On the other hand, at least several panelists expressed the opinion that there would be mounting political pressures to establish systems of this type since all countries would want to have access to the most current developments in science and technology, and thus political barriers may fall earlier than the majority are willing to anticipate.

Figure 2D illustrates the views of the panel with regard to the future of multinational man-machine interaction.

The panel seemed fairly confident that a great number of people living in industrial areas of the world would be interacting with computers by 1990 at the latest. In answer to another question, 72 percent agreed that “the inability to effectively interact with computers will be viewed as a particularly disabling form of illiteracy.” Presumably this assumes a considerable simplification in the processes of man-machine interaction and a general movement toward the computer as a major means for augmenting human intellect through access to multinational data bases, on-line conferencing, etc.

PUBLIC POLICY AND ADMINISTRATION

One of the major themes emphasized by the panel members throughout this study was that the use of computers across national boundaries is infused with a public character such that increased public regulation would be inevitable. In fact, one of the distinguishing features of institutions that may emerge from the use of MNCS is that they might tend to blur the distinction between public and private domains of action, since the use of such systems requires the utilization of public communications networks on a large scale. The effects of this interaction, however, are not entirely clear from the comments of the panel members. As shown in Figure 3A many respondents felt that the MNCS had at least some impact on aggravating tensions between nation-states and multinational corporations. Those who expect a high impact do so because they feel that MNCS will make multinational corporations more powerful, but a significant minority (36 percent) believe that the use of MNCS might actually reduce tensions, since it would make visible much information now closely held or hidden by corporations.

Figure 3B suggests that some kind of mechanism might be needed to resolve these tensions and this was confirmed by the fact that 91 percent listed as one of the most important barriers to the use of multinational computer systems “the lack of legal or political mechanisms to resolve conflicts over who controls multinational data banks.” Moreover, 61 percent agreed “there is a lack of international coordination in all areas concerned with computer sciences, particularly hardware and software interfacing standards.”

Probing further in this area, the panel was nearly unanimous that “the inhibiting role of political ideologies, particularly the notion of national sovereignty, but also the tensions between capitalism and socialism, multinationalism and nationalism, etc.” was a major barrier and in fact, this was cited as the single most important barrier to the use of computers across national boundaries. The panel was less concerned with national language differences (only 40 percent cited this), but nearly 70 percent felt that an important barrier was that “nations will be preoccupied with the military significance of multinational data systems, both from the point of view of linking together military allies and from the point of view of protecting such systems from enemy infiltration.” Thus,
Question 34

The use of computers across national boundaries will accelerate the trend toward increased tension between nation-states and multinational corporations.

- Slight Impact
- Some Impact
- Substantial Impact
- Maximum Impact

3B

Scenario B-4

One result of the use of computers across national boundaries will be that regional "Development Agencies" or some other mechanism will be needed to resolve tensions between nation-states and multinational organizations that emanate from the manner in which these organizations use information to make decisions regarding the goals and objectives of economic development.

- Strongly Disagree
- Disagree
- No Opinion
- Agree
- Strongly Agree

3C

Question 25

In what year will a mechanism (e.g., an international ombudsman agency) be established among at least 5 countries to adjudicate disputes arising out of the transmission of data across national boundaries?

- 1975
- 1980
- 1985
- 1990
- 1995
- 2000
- Never

3D

Question 26

In what year will international conventions regarding information flows across national boundaries, including laws on wiretapping, fraudulent uses of data, etc., be ratified by at least 5 countries?

- 1975
- 1980
- 1985
- 1990
- 1995
- 2000
- Never

They feel that language and technical differences could be solved much more easily than political barriers, which seem to be the major constraints.

How could these political problems be overcome? Figure 3C may provide some clues in that a majority of the panel believes that some form of judicial machinery (some were very much opposed to the notion of an ombudsman for this purpose) would be needed to adjudicate disputes arising out of data transmission across national boundaries, and that such a mechanism will be developed by 1990 or shortly thereafter. Although some panel members felt that there are too many political barriers for this event ever to come about, others pointed out that the International Standards Association is currently formulating a proposal along these lines and that precedents are being set in other areas such as environmental monitoring and law enforcement. The picture in Figure 3D goes one step further and suggests that panel members do not see international conventions on information flows across national boundaries until at least 1985 and that, even then, there will be serious problems because people from diverse cultures do not necessarily share a common set of values concerning the nature of fraudulent use of data. For example, the United States and Western European countries have differing legal concepts about the nature of price fixing by corporate organizations and the types of collusion that are permissible.

The conflict between the individual's right to privacy and society's right to use computers and data bases for planning purposes is much in the news in the United States. The panel agreed that at the moment, "there is a lack of multinational agreement on the protection of individual privacy and the limits of government censorship on data transfers across national boundaries." When asked in what year there will be an international agreement to protect the privacy of individuals such that agencies of all types would not use data dossiers in ways considered to be repugnant to individuals, most of the panel responded that such agreements would not occur in the next fifteen years and 38 percent even indicated that international agreements on this subject would never be signed. Some of them pointed out that there might be limited agreements of this sort between a few very close neighbors such as the United States and Canada, but they were very pessimistic about larger scale agreements. Some said that differing concepts of individual rights and civil liberties would preclude the possibility of defining the issue at the multinational level, and others felt that even if agreement on definition were possible, it would still be politically unfeasible to design machinery at the global level to police the agreement. If such agreements cannot be formulated, this is likely to raise some very difficult problems in deciding what kinds of data can be transmitted.
across national boundaries and how the flows could be regulated.

Some of the public areas in which the use of multinational computer systems may have an important impact are illustrated in Figure 4. In all the listed areas, the panelists expected very great progress before 1990, with the possible exception of the utilization of natural resources where the major stumbling block appears to be the national economic plans of individual countries and their reluctance to permit some form of global economic planning or decision-making regarding their resources.

In addition to the areas cited in Figure 4, the panel very strongly agreed that by 1990, at least half of all foreign exchange operations will be carried out by multinational computer systems linking together the large international banks. They were similarly highly confident (i.e., 95 percent agreement) that by 1990, a medical data bank will be established to service, on an on-line basis, at least 25 percent of all multinational organizations throughout the world.

MULTINATIONAL BUSINESS ADMINISTRATION

Earlier in this paper, it was pointed out that there are already many examples of multinational management information systems in operation for various purposes. To explore the proliferation of these systems, the panel was asked in what year at least 25 percent of all multinational organizations would use multinational information systems in dealing with certain problems. As indicated in Figure 5, very great progress is expected in these areas within the next ten to fifteen years. The researchers were particularly interested in the impact of these applications on management theory and practice. Some of the relevant findings in this area are summarized below:

1. There was strong agreement that multinational computer systems will make it possible to more closely integrate the management and research skills of one geographic area with the production and natural resource usage of another.

2. The majority of the panel members (78 percent) believed that computer technology per se, not necessarily the use of MNCS but also including it, would accelerate the trend toward professionalization of management around the world. That is, with the increasing use of computers in big business organizations, the management education required to utilize this technology would likely create uniformities in management behavior and practice in diverse cultural contexts around the world.

3. 78 percent agreed that multinational computer systems will help to enhance the power and influence of multinational organizations whose interests transcend national interests. Since these multinational organizations tend to be financed and dominated by the highly industrialized countries, their increased power and influence may tend to widen the gap between the rich and the poor nations.

4. 80 percent disagreed with the concern sometimes expressed in the literature that multinational computer systems will create large, hierarchical, highly centralized and unflexible management organizations. In fact, according to some panel members, the use of MNCS by a corporation might have quite the opposite effect since the widespread use of remote terminals throughout an organization to collect data, transmit it to a central computer facility, and then receive it back in a form useful for local decision-making, would have a tendency to decentralize the overall structure of multinational corporations.

5. Many panel members agreed that the spread of multinational computer systems will create problems of national citizenship and organizational loyalty. For example, employees of multinational corporations could be asked to make decisions that may not be consistent with the policies of their own governments. Management may be forced to deal with these problems of loyalty at all levels in the organization and some of them may involve legal considerations since individuals may be making decisions within conflicting legal systems (differing laws of nation-states, world law vs. nation-state law, etc.).

6. 60 percent agreed that multinational computer systems will help to redefine the meaning of work and leisure by freeing people who work through distributed computer networks from time and place constraints associated with traditional modes of work. This suggests that people might work in decentralized information centers or perhaps in their home or other choice of location by communicating in the
real time mode with people in other locations, even across national boundaries. Although no time perspective was attached to this statement, a number of panel members believed this alteration of work habits was possible for at least some sector of the population in the next twenty years.

7. 55 percent of the panel agreed that multinational computer systems might have some slight impact, if any at all, on the multinationalization of union activity. Many panel members believe that most union policies will continue to be made at the national level.

8. The panel, by a 66 percent majority, appeared to agree that the use of multinational computer systems would have, at best, a slight impact on the trend toward uniformity in multinational law, including tax laws, anti-trust laws and the chartering of corporations. The feeling was that these matters of law were deeply rooted in national legal philosophies and would unlikely be changed by the use of MNCS. Conflicting notions of monopolistic behavior and effective tax rates would seriously delay cooperation in defining a set of multinational laws regarding the behavior of multinational corporations.

IMPACTS ON THE DEVELOPING NATIONS

The issue of the relationship between MNCS and economic development was explored in several questions of the Delphi questionnaire. The panel strongly agreed that world economic development will be greatly affected by the globalization of information processing. They also agreed, by a 72 percent majority, that the use of MNCS should help the developing countries enormously by tying them into advanced technologies, suggesting that the MNCS itself may constitute a potential vehicle for acceleration of technology transfer. The suggestion was also made by 71 percent of the panel that the developing countries will be motivated to have their own large computers for prestige purposes, much as African countries have done in their investment in airlines. The majority (67 percent) believes that the use of MNCS will make the developing countries “more familiar” to corporations desiring to establish facilities in their country and thereby will accelerate industrialization.

All this optimism does not indicate that the panel expects the developing countries to be uniformly assisted by the development of multinational computer systems. On the contrary, most of the participants do not feel that the use of MNCS would narrow the gaps presently existing between the rich and poor nations. Some observed that a form of “information dependency” might be a likely consequence of this development. Moreover, 55 percent agreed that the developing countries will not have enough people with needed computer skills to benefit from the use of MNCS in the foreseeable future.

Some other positions of the panel with regard to developing countries are summarized below:

1. Most of the panel (90 percent) felt that the use of MNCS could be a strong force in bringing about changes in education, management, medicine and public administration in the less developed countries. Similarly, 92 percent agreed that the use of MNCS will provide opportunities for developing nations to improve public administration in such areas as obtaining statistics, planning and finance.

2. A majority (76 percent) agreed that multinational computer systems will help to institutionalize a method of socioeconomic change whose origins are multinational, thus competing with national strategies of change.

3. A majority of the panel (70 percent) felt that the use of MNCS will have little impact in the developing countries unless developed nations subsidize the development of computer technology in the LDCs and promote the development of the skills and capabilities required to fully utilize computer technology.

4. The impacts of MNCS on the less developed countries are likely to be asymmetric in nature and should be evaluated on a country by country basis. Nonetheless, it will likely become one of the major vehicles by which technology is transferred across national borders and will definitely help to further integrate the developing countries into the world economic structure.

SUMMARY AND CONCLUSIONS

In this paper, we have been able to present only the highlights of a much more detailed study of the possible social implications of the use of computers across national boundaries. The clearest lesson from the study was that there will indeed be some major impacts, and many of them will occur in the next ten years, but that the nature of these impacts are still only vaguely perceived. Nevertheless, certain conclusions seem safe to make at this time.

The use of computers across national boundaries in both the public and the private sectors will expand very greatly in the next two decades as the costs of computation decline, new applications are proven economical, and the scope and influence of multinational organizations increase. On the technical side, there appear to be few barriers to the development of MNCS that are not now already close to solution. The problems that do exist are more in the nature of political or socio-cultural and while there is no guarantee that all these barriers can be swept away in the next two decades, there are promising starts already.

In the public sector, the use of computers across national boundaries will strengthen multinational public
enterprises in such areas as public health, criminal activity, pollution, weather and disaster control, with major impacts before 1985. New institutions will be required at the multinational level to resolve disputes over the transmission of data across national boundaries, to develop regulations concerning the activities of multinational data banks, to provide individual safeguards, and to deal with problems of standardization of data transmission facilities and capabilities. In the private sector, progress may be even faster because much can be done within individual companies. As a result, the use of MNCS is already beginning to enhance the power of multinational corporations vis-a-vis the nation-state while at the same time contributing to a growing uniformity of business practices throughout the world.

These developments are likely to have their most profound and least understood impacts on the socio-cultural level. Within the highly industrialized societies, many people will find themselves in some form of man-machine relationship, often involving multinational communications, within the next decade. These interactions may be for educational, health, library, business, or other reasons but the net effects will be the enhancement of shared beliefs and values and a growing sense of interdependence on matters of the most fundamental nature. One effect of this, for example, might be to create new problems of national citizenship and organizational loyalty whereby individuals will be asked to make decisions in a multinational context that may not be consistent with the policies of their own governments.

In the developing nations, the widespread use of MNCS may be considerably delayed, perhaps for fifteen or twenty years, but when it happens it will have enormous impacts. In the short run, the use of MNCS may tend to enhance the economic interests of the information-rich, wealthier nations at the expense of the information-poor, but in the long run, the use of MNCS will increase the technological options available to the LDCs and speed up their ability to industrialize, and to take advantage of the latest developments in education, management, medicine or public administration. The danger to the developing nations is that the MNCS may distort their investment priorities or lead to policies that favor multinational as opposed to national socioeconomic change. This provides a new challenge to the developed nations to create international organizations and agreements that strengthen the position of the developing countries in regard to all flows of science and technology, particularly the use of MNCS.

In the long run, we may find that the use of computers across national boundaries will be one of the three or four most important factors tending to bring the world closer together through the creation of new multinational institutions and interdependencies. If this should happen, the impact on human society will have been truly revolutionary—perhaps equal to the impact of the invention of the printing press or of human language itself. The main contribution of the data developed in this study has been to suggest that these impacts may begin to be felt sooner rather than later—before 1985 for many of them—and that it is not too early to begin to plan how to avoid the obvious traps and to assure the greatest benefit for the world’s peoples.

REFERENCES

15. Delphi is a method of collecting expert opinion using a series of highly structured questionnaires designed to provide feedback to the panelists while avoiding undue peer pressures. See Helmer, Olaf, Social Technology, Basic Books Inc., New York, 1966.
16. Delphi has been criticized by some as not being statistically valid, of not weighing the relative degree of expertness of each participant in relation to each question, of not testing for reliability, etc. These limitations, while very real if the objective is a scientifically reproducible experiment in forecasting, were considered to be less important here where the object was simply to identify issues and explicate positions.

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