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INFORMATION SCIENCES AND COMMUNICATIONS TECHNOLOGY:

THE CHALLENGES OF FOREIGN ASSISTANCE

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I INTRODUCTION

There has been a great deal of interest generated in the development community by the extraordinary recent advances in information technology. The field appears to offer solutions to many of the pervasive problems of development. However, there is no area of modern technology which combines so many potential difficulties of transfer and implementation with such high promise. This paper constitutes a preliminary examination of the dichotomy between promise and problem in the application of information technologies to development. My objective is to identify some central issues which must be addressed in designing and implementing technical assistance programs. The analysis shows that we are beginning to understand some of the important development implications of information technologies but badly need a more coherent framework for U.S. foreign assistance in this area.

I should first specify what I mean by "information technology". To begin, at least, I define the term very broadly to include conventional communications systems using telephones, as well as satellite and fiber optic communications systems; television, microprocessors, computers (particularly microcomputers); and all of the "software", applications and combinations of these technologies that are under such rapid development today including robotics and computer/video systems, for example.

This combination of technologies is often referred to as revolutionary: "the information revolution", or in Robert Textor's descriptive, if awkward phase, the "telemicroelectronic revolution (1)". These are the technologies which form the basis for Alvin Toffler's "Third Wave" in human history (2). The potential implications are ranked by these and many other authors with the impacts of the introduction of organized agriculture and the industrial revolution.

It is not particularly relevant to our argument whether or not the "information revolution" can justifiably be compared to the industrial revolution. What is relevant is the apparent applicability of many of these technologies to basic issues and problems of development. One of the critical barriers to development is that many people making

decisions, from the farmer deciding on when and what to plant to the health worker deciding on how to treat a disease to the industrial plant manager deciding on control settings, have neither the basic knowledge nor the specific information to make the correct decision. In each case there is some quite obvious application of information technology: for example, training based on interactive video, or microprocessor controls, or expert systems, or easy access to specific information and advice which could contribute significantly to effectiveness. Along with the availability of capital there is nothing more important than the availability of information - or "know-how" - at the right place and the right time. This would include the "know-how" that is embedded in, as well as accessed by, a computer chip or a microprocessor.

Daniel Bell, in writing about the "Post Industrial Society" alerted us to the fact that "a post-industrial transformation provides no 'answers'. It only establishes new promises and new powers, new constraints and new questions - with the difference that these are now on a scale that had never been previously imagined in history".(3)

Bell was writing about an indigenous evolution to a post-industrial state. His caution is even more apt as applied to developing countries. We must recognize that the technologies of the "information age" are products of that post-industrial society; their character, one might even say their basic nature, is molded by the characteristics of that society. Applying those technologies to pre-industrial or industrializing developing countries raises profound issues of both desirability and feasibility. There is, perhaps, no better example of the potential and problems of technological leap-frogging.

A further consideration adds to the urgency of applying information technologies to developing countries. Whatever the developing countries do, it is clear that the industrialized world is applying the full array of information technologies - microprocessors, microcomputers, information systems - virtually everywhere. This is happening spontaneously because of their recognized economic value. If the developing countries do not make appropriate use of these technologies the gap between the rich and the poor countries of the world will be further increased.

The number and range of applications which can contribute to this gap is extraordinary. One example, on the hardw. ·e side, is the inexpensive microprocessor which, by monitoring and controlling plant operations, makes a manufacturing plant more efficient and the product cheaper. An example on the information side refers to the increasingly dispersed nature of production sometimes referred to as the "global factory". To be a part of that factory, to be able to sell into the highly competitive, well informed markets of today, a supplier must itself be well informed. "Being well informed" once had an unrushed, well read thoughtfulness about it. Now it implies prompt access to and critical evaluation of large amounts of current data.

Information technologies, products of the post-industrial world, are in a sense alien to the developing world. Their adoption in appropriate and productive areas will not happen spontaneously. At the same time success is unlikely if these technologies are forced into the system by governments or outside agencies. Hence the critically important role and the difficulty of foreign technical assistance. In the next section I suggest some issues that must be addressed if that assistance is to be effective.

II ISSUES

A. THE DAZZLE EFFECT

Jacques Barzun recently observed that "few things are more characteristic of the modern mind than to take complication for improvement"(4). Barzun was, in fact, writing about literary criticism but his observation serves as a warning not to assume that dazzling new information technologies can, simply by being put in place, solve major problems.

In the microcomputer area we have already observed a tendency to overestimate the role of hardware(5). It is true, of course, that innovations in hardware were the determinant technological change. The development of the microchip made possible the explosion of microcomputer applications. The fallacy, however, has been, when faced with a programmatic need to ascribe hardware the highest importance followed by software, then a consideration of adaptation and training and, finally, institutional development. I would argue that the relative importance should be ascribed in just the opposite order.

There are already some examples of health and agricultural educational programs in which a fascination with television has interfered with important progress with a system based on the radio. Without effective programs and institutions, the TV systems absorbed attention and funds, to the detriment of the radio system; the result was a deterioration in the services provided rather than an improvement.

Another example can be drawn from the remote sensing area. Considerable enthusiasm has developed for the application of various satellite imaging techniques for weather and crop forecasting. In coordination with observations on the ground, such techniques can assist farmers in their planting and harvesting decisions; they can also provide an "early warning" system for managers of emergency food supply programs. Recently, researchers have realized that aircraft or observation balloons can often provide information on a more cost-effective basis than satellites for at least some of these programs. Technological choice can not be finessed by simply opting for the newest and highest tech.

There are two fairly obvious implications of this issue. First, applications of information technologies should be driven from needs, not by the technologies, no matter how dazzling those technologies may be. Second, there is a very big job to be done by technical assistance agencies such as USAID in understanding in some practical detail where and how information technologies can be applied to the problems of development; in choosing the appropriate technology to apply; and then in implementing programs in policy and institutional development so that the tremendous potential of the technologies can indeed be realized.

B. THE DUAL SECTOR PROBLEM

A microcomputer; rapid, reliable communication; on-line information systems; none of these things have any value in themselves. They have value only as they contribute to a sectoral developmental objective such as the provision of health services, greater agricultural productivity or more efficient power production. Thus, not only is it necessary to develop national capability in the information technologies themselves, but it is also necessary to wed that expertise to that in the traditional sectors of health, education, industry, agriculture, energy, government, etc.

Such marriages may or may not be difficult, depending on the particular circumstances. In several countries, at least, both interdisciplinary and interagency collaboration are difficult and a concerted effort must be made to effect them.

The dual sector problem has a number of implications. One is to seek out those applications in which the problem is minimized. For example, upgrading a country's communications system may have benefits in many sectors without having to involve those sectors directly. But such applications are limited. The full potential of the technologies will not be realized unless the dual sector problem is addressed in program and policy development and in building new institutions. Here again there is a clear and necessary role for foreign assistance not only in providing expertise but also in providing a mechanism to rise above institutional parochialism.

C. SYSTEMS SELECTION AND INTEGRATION

There is a problem akin to the dual sector problem within the domain of information technologies itself. Many of the most productive applications of information technologies require not just one process of piece of equipment, but several. An agricultural management system, for example might include reception and computer analysis of satellite images, telecommunication of ground-based information, mainframe computer modeling of weather patterns, access to and analysis of on-line data regarding commodity prices and crops in other countries and communication with farmers.

There are very significant problems associated not only with the choice of individual components of such a system but also with integrating such a system into an effective whole. In a developing country the job of choosing components and integrating them is particularly difficult because of lack of current information, a multinational cast of vendors and a variety of sources of equipment and program financing.

This suggests an important and appropriate role for technical assistance. Such assistance could take several forms, including a central site for training and the demonstration of alternative technologies. Indeed the problems of systems integration is just one example of many issues of national computer policy which warrant concerted attention and are appropriate subjects for technical assistance.

D. STRUCTURAL REALITIES

Certain basic structural characteristics of developing country governments must be taken into account in judging the feasibility of, and in designing programs in technology transfer in information technology. Anyone who has worked on projects requiring information from many sources has run into the reluctance of government officials to give out information. One of the fundamental premises of the information revolution is that information is a valuable resource; "information is power". In government bureaucracies, in "developed" as well as developing countries. power often comes from withholding information.

At least some of the value of information technologies are closely linked to the nature of a decentralized governmental and social structure in which decisions are made "in the field" by many actors. An illustration of this point comes from a North African country's agricultural extension program. Initially the program was successful because there was a flow of information in both directions - technical information from the Ministry of Agriculture to the farmer and information on needs and results from the farmer to the Ministry. Gradually, the prevailing strong top-down character of the governmental structure prevailed and the "feedback signal" was overwhelmed. The program rapidly lost effectiveness.

This issue reinforces the importance of a needs-driven or bottom-up approach to program development and the need to manage programs actively to assure continued relevance. The technology itself is not sufficient.

E. QUANTIFICATION OF BENEFITS

In some instances the benefits of the implementation of an information technology can be quantified directly. For example, improved information flow and plant dispatch of a power system can directly reduce both fuel requirements and the need for capital investment. In other instances, however - and these are the most common - the benefits of information technologies are indirect. The total benefits of telecommunication systems, for example, can be far greater (40-80 times greater in some cases) than the usual economic measure of benefit, namely revenues or even willingness to pay.

The externalities, or indirect benefits of investment in information technologies are generally shorter term and more tangible than, say, investment in education. They may include increases in output, productivity or exports. While large uncertainties may have to be attached to such estimates of benefit it is important that a serious attempt be made to make such estimates. It may well be that from a development perspective we have seriously underinvested in communications systems in the past. It is important that we develop and apply an appropriate cost-benefit calculus to programs involving new, and old, information technologies.

This issue, and those raised above, imply the need for greater attention in information technology programs to project evaluation. Such evaluations, both during and at the end of projects, can be invaluable in understanding the constraints to project implementation and in building up an improved understanding of external benefits.

F. ROLE OF THE PRIVATE SECTOR

Much of the relevant technology in this rapidly moving area resides in the private sector. If it is to be effective in implementing advanced information technologies USAID must establish closer collaborative relationships with private industry than has been the case in the past. A small, but effective example of such collaboration is the use of the Telecommunications Training Institute, an organization funded by AT&T, MCI, Comsat and others, for training of developing country professionals.

It might be noted that there is a significant potential for U.S. exports to developing countries in this field. There is no doubt that our trading partners, Japan, Germany and others, will actively exploit the usual close coordination of their commercial and assistance interests. In this area, because of the high developmental benefit-cost ratio of many technologies, the controlled harnessing of commercial interests may have significant development benefits.

G. THE ADAPTATION OF TECHNOLOGY

As suggested above, in a fundamental sense many information technologies are alien to the developing world. They grew almost spontaneously out of the post-industrial character and needs of Western society. The needs and potential applications of information technologies in developing countries are in some cases quite different. To say that we will take these needs into account in designing technical assistance programs is, at best, facile and naive, and, at worst patronizing. It underestimates both the problem and the potential for these technologies. It is not only a question of adaptation but somehow

"making the technology indigenous". The full fruits of information technologies will be borne in developing countries only when those countries, in a sense, recreate the technologies in the image of their own needs and ways of thinking.

A corollary of this need is that we can not always predict how information technologies will be used. The fundamental character of this area of development may call for a more adventurous approach to assistance, less exacting in predicting and deducing benefits. A further corollary is that technical assistance in this area requires a more active and more forward-thinking process of project evaluation.

The challenge, therefore, is to create the conditions - financial, institutional and human - for appropriate indigenous innovation in information technology. One element in that process might be the introduction of computers into secondary schools and colleges. The history of microcomputers in the U.S. attests to the creative value of a computer-enthusiastic and knowledgeable young population. Early efforts in developing countries support the generality of that experience(6). But a much wider set of experiments, institutional innovations and human resource development initiatives will be required.

H. USAID'S PROGRAMMATIC STRUCTURE

A strong point of USAID's program development has always been its responsiveness to local conditions and needs. The emphasis on bottom-up program development, however, has carried with it corresponding weakness in terms of being able to respond to assistance policy directions or generic technological opportunities that originated above the country level. USAID's program is broken down on sectoral lines so the dual sector problem described above also applies to it.

In terms of the potential contributions of information technologies this issue has two aspects. One is the question of how programs are formulated. The other is the question of how such programs are implemented in the field given the lack of expertise in the relevant

professional disciplines within USAID missions. In addition to a clear role for the Bureau of Science and Technology the solution to this problem may also involve a stronger than usual role for the private sector, as discussed above.

A special characteristic of this field should be mentioned in this regard. Some of the key technologies at issue here can themselves be used in the formulation and management of USAID country programs. For example, remote sensing, as applied to natural resource development planning and agricultural planning and management can serve USAID's program development and management needs as well. The development of local technical capability could therefore contribute to USAID's programmatic analysis as well as to that of the national Government.

I. THE DARK SIDE

No technology of such breadth and magnitude can be all good. In formulating a foreign assistance policy in communication technology one must keep in mind potentially harmful applications or effects as well as the intended benefits.

I have already spoken of the need to make these technologies indigenous. That process should aim at avoiding damage to the culture and traditional values of the country as well as stimulating the most productive local applications. Many have written of the danger of creating an elite by selective adoption of communications technologies, or of their magnifying existing inequalities. This potential exists, but so does the far more exciting potential of using the technologies to reduce inequalities. The choice is up to the country.

Finally, there is the danger that these technologies will be usurped by a malevolent government to accomplish its nefarious ends. There is certainly that possibility but there are ways of implementing communication technologies, essentially those which emphasize decentralization, which, in fact, make autocracy less likely.

III CONCLUSIONS

In this paper I have not dwelled on the large number of potential applications of information sciences and communications technologies in developing countries. These are sufficiently numerous and obvious that that is not the basic issue. More critical are the questions of which programmatic areas to pursue and how to go about pursuing them. This paper has indicated a few of the issues that might be of concern in addressing these questions but clearly we have merely scratched the surface of a hard, complex and important problem.

The potential contributions of information technologies are sufficiently great, and the issues are sufficiently complex, that a thorough analysis of this subject is called for. Given the potential benefit of these technologies if they are applied appropriately and the potential harm if they are not, it would seem to be an obligation on USAID's part to tackle this problem seriously.

An analysis of USAID's role in this area should be based on a technology assessment in a development context and should consider all aspects of U.S. interests in foreign assistance as well as USAID's current mandate.

As a final note I would hazard a prediction. If we are successful in applying information sciences and communications technologies to developing countries, twenty-five years from now we, or our successors, will not be talking much about them. This is a subtle revolution. The technologies are so fundamental that they will disappear as the book has disappeared behind content and meaning. However, if we are successful, then virtually every programmatic area of technical assistance will have been touched and rendered more effective by those technologies and our contribution to the process of development will be that much greater.

REFERENCES

1. Robert B. Textor, "Anticipatory Anthropology and the Telemicroelectronic Revolution: A Preliminary Report from Silicon Valley", Anthropology and Education Quarterly 16, 3, 1985.

2. Alvin Toffler, The Third Wave, Bantam Books.

3. Daniel Bell, The Coming of Post Industrial Society. Basic Books, 1973; Forward of the 1976 edition.

4. Jacques Barzun, New York Times Book Review, June 21, 1987.

5. James S. Munson, Philip F. Palmedo, et al., "The Use of Microcomputers in Energy Planning for Developing Countries". Energy/Development International, Setauket, N.Y. 1983.

6. See, for example, "Computers in Education: An Outline of Country Experiences." Report of the Asian Seminar of Educational Technology. (Tokyo, Japan, September 26 - October 2, 1984). United Nations Educational, Scientific and Cultural Organization, Bangkok (Thailand). Regional Office for Education in Asia and the Pacific. 1985