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INFORMATION SYSTEMS AND DEVELOPMENT IN THE THIRD WORLD*

JAMES HEITZMAN
Cazenovia College, Cazenovia, NY 13035, U.S.A.

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Abstract—The shift in global economy toward the development of services, including information systems, offers challenges to Third World nations from five directions: microelectronics technology, a multiplicity of development theories or policies, the power of multinational corporations, international information agencies, and variables of national political economy. In the face of these challenges, developing nations start from a position of weakness, based on low levels of capital formation and rapid population growth. The resulting problems include low levels of investment in information infrastructures, lack of public interest in modern information facilities, and dependence on the multinationals. Responses are varied, however, as seen in the South Asian nations of India, Pakistan, Sri Lanka, and Bangladesh. The general direction of solutions in the late 1980s is away from large-scale, centralized intervention and toward more decentralized national and regional projects.

THE STRUCTURE OF DISCOURSE

In this paper I will discuss the relationship between information and development in the poorer countries of the world during the 1980s and into the 1990s. This is at first glance a doubly difficult undertaking, first because the fields of both information and development are extremely wide, with indistinct boundaries shading into a variety of disciplines, and second because the two fields are so widely separated—information studies typically investigate literate people and at present concentrate on high-technology man-machine interfaces, while development studies have concentrated on less literate populations and on industrial or agricultural growth. However, information is becoming increasingly central to the process of development, and is the subject of intense planning and implementation efforts by multinational corporations, national governments, and international agencies alike. The intensive effort expended on information technology and the reorganization of work will transform leading-edge economies in all countries into an international information society within the near future. My purpose here is to describe

1. actors and intellectual perspectives relating to information for development;
2. current problems connected with the international information order;
3. the general direction of solutions for the Third World.

This paper will concentrate in particular on South Asia, which exemplifies in a smaller compass the impact of information on the poorer nations, and where a variety of programs and changes highlight national responses to the information challenge.

The relationship of information to international development remained in the background of public discourse until the 1970s, relegated to the realm of "comparative librarianship" where it really signified descriptions of varying library practices in different world areas. The situation changed when new computer and communications technology began to change the economies and cultures of some of the more developed countries. The earlier movement away from agriculture and into industrial production was nearly complete;

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the next stage was a transformation into "post-industrial" economies where "knowledge-based" industries resting on information flow and telecommunications employed an increasing majority of the labor force and molded an "information society" of electronics consumers. As microelectronics empires grew, observers became more aware of information and information systems as capital or as major facets of decision-making, and branches of the social sciences began to investigate and quantify the contribution of information to economic activities (Bell, 1973; Lamberton, 1985:207–09). Development specialists had generally existed in a parallel universe, properly concerned with primary production, industrial growth, and the basic administrative infrastructures necessary to support galloping populations. But as microelectronics began to change the developed world, representatives of the poorer nations correctly perceived the significance of the new technologies. On the Pacific Rim, The Republic of Korea, Taiwan, Hong Kong, and Singapore were able to position their fledgling electronic industries within production niches that fed expanding microelectronics markets, helping to transform themselves into Newly Industrialized Nations (*Information Activities, Electronics and Telecommunications Technologies*, 1981:117–23). Other Third World countries, unable to make this transformation, saw the new technologies as a threat, leading to wider technological gaps and increasing dependence on the information societies. Telematics, or the joint field of computers and telecommunication, joined with information management as growing issues in national development planning and in international forums.

There are five main vectors that come together around information for development. Two of these vectors are macro-level phenomena. The first, certainly the most prominent in the public's eye, is the technology of microelectronics that includes computers and telecommunications, the latter including broadcast systems such as radio and television and the transmission media such as cable and satellites used for news, entertainment and propaganda as well as digital data transfer. Rapid advances in research, development, and available technology continually revolutionize the capabilities of microelectronics, compounding the problem of planning. The second vector is the intellectual field of development studies, which has experienced its own revolutions, most notably the recurring debate between a model of economic "take-off" relying on industrial production and a model of "basic needs" for large segments of a population (Dosa, 1985:147–49). Development theorists have generally remained distant from microelectronics, viewing it as an "inappropriate" technology for the overwhelmingly rural peoples of the Third World. In practice, the role of microelectronics is quite significant in national planning. The newly industrialized countries of Asia are now full participants in the microelectronics revolution as producers and consumers with increasing needs for the same level of information as the developed nations. The large developing countries (India, Brazil, China, Mexico, and Argentina) are capable of mobilizing sizeable resources to selectively create modern technological infrastructures, although they leave a large percentage of their people behind. The majority of least developed nations are incapable, because of their small populations and/or resource bases, of creating a modern information infrastructure within the near future. Differentiation within the Third World, and even between different areas within the same country, makes it impossible to prescribe a single package of policies for all developing nations.

The remaining vectors are institutional. The third is agencies of modern capitalism—the electronics industry itself, dominated by multinational corporations (MNCs), and the financial markets and the MNCs that need and use modern facilities to collect, transfer, process, and use data for business purposes. These powerful agencies are most interested in preserving the free flow of data and information to facilitate their own intelligence systems, while the MNCs specializing in electronics still dominate the production and distribution of modern telematics equipment. In fact, it can be argued that the existence and growth of the international information order rest on the imperatives of the MNCs (Nora and Minc, 1980:68–73; Schiller, 1988). On the other hand, there are the institutions of the fourth vector—international government agencies such as UNESCO that attempt to regulate telematics and implement procedures that spread the benefits of information to all nations. Relatively poorly funded, international organizations have divided their resources along three lines: running consultancy operations, international meetings, and clearing-

houses for information on information; creating tools and institutions for world-wide transfer of information; and supporting local, experimental projects within individual nations. Despite many notable successes in all these areas, the international agencies have not been able to implement either an overarching global policy or templates for national development of information resources. The recent stance even of international agencies is that the wide variety of conditions in different developing countries means that national information policies, geared to the specifics of each nation, are the prerequisite for international information systems (*Scientific and Technological Information*, pp. 14–15).

This brings us to the last vector—national programs, which evolve in response to pressures from new technology and the MNCs while attempting to link up with the international planning agencies. The role of information in national development policies varies greatly, depending upon the size and resource base of the country as well as its political system. Brazil, for example, was able to implement a centralized, aggressive policy of endogenous development in the microelectronics industry because of its larger resources (which allowed it to stand up against MNCs) and its autocratic political centralization after 1974 (Hobday, 1985:326–44). India, with a more decentralized political system, made slower progress in endogenous telecommunications development but was successful in regulating its computer industry (see below). The ASEAN countries have followed policies that encourage export-oriented industrialization, purchase of equipment and know-how from MNCs, and integration of national information systems with international systems of the West (Sussman, 1988). National programs thus depend to a great extent on internal conditions of political economy, which make this vector the most significant of them all. Indeed, variables of information technology and the national knowledge industry as a whole depend on other indices of national economy and political stability (*Information* Activities, Electronic and Telecommunication Technologies, 1981:123–34, 149–60; Eres, 1985; *Automation Technology in Management in Selected Asian Countries*, 1987:39–43, 65–66).

As an issue of widening significance at the intersection of large fields, information for development attracts a wide range of research—but perhaps it is too wide. Menou has summarized some of the main approaches in this area, including studies of technological diffusion, bibliometric projects on scientific productivity and literature, mapping of the "knowledge industry" of a country or an economic area (following Machlup's 1962 study), or surveys of information institutions such as libraries or specialized agencies. Menou's own work has aimed at the creation of an "index of informationization" for different countries, using socio-economic measures as well as technical criteria as a basis for development planning (Menou, 1985:173–74). Much research rests on the unquestioned assumption that bigger numbers mean more information which leads to greater productivity, although there are only crude analyses of costs and benefits of information in any decision-making process. The "more is better" assumption, a kind of "supply-side" economics of information, often posits that existing relationships are optimal and ignores distributional inequalities, ignoring in turn the value of information in social context (Lamberton, 1983:36–39). In this situation, it is not surprising that many information services fail in the Third World as elsewhere; indeed, the criteria for success of any implementation are the most important but perhaps the least discussed aspects of development literature (Dosa, 1983:315–16).

If we widen the domain of information studies to include communication, we obtain a much richer body of theoretical and practical research related to development. In fact, many areas of media studies associated with communication curricula in the United States fall under the rubric of information studies in Japan. Youichi Ito, speaking from this perspective, has described four approaches to "information societies" that may serve as a guide for planning and development in general:

1. The "information census," or measurement of amounts of information (however defined) produced and consumed;
2. correlation of the measurement of information with other socio-political factors to determine the impact of "informationization;"

3. study of "channels" for transmitting effective information;
4. study of policy implications and organization for optimal levels of useful information (Ito, 1980:254).

This fourfold division of activity is not only a template for systems analysis, but a means for tapping into the wide range of communication literature as well. For example, Hamid Mowlana concentrates only on international information "flows" (channels) to discuss communication literature on development issues related to broadcasting, transborder data flows, remote sensing, and news programming. Work in these areas rests on well-established theoretical approaches—international relations, organization studies, political economy, technology, law, and development theory (Mowlana, 1985). Similarly, Ito's "information census" corresponds to a large body of work such as Porat's study of the U.S. information economy (Porat, 1977) or OECD studies of the international information industry (*Information Activities, Electronics and Telecommunication Technologies*, 1981). Expanding the domain of information studies, therefore, leads to a substantial development literature on information. The relationship between this research and actual policies remains, paradoxically, one of the least studied of its features.

THE PROBLEM

All of the so-called developing countries start from the same basic causes of poverty: antiquated political economies based on agriculture, and rising population. Because these economies are not able to generate a high level of surplus capital, there are insufficient funds for the social and technical infrastructure necessary to create alternative economic forms. This infrastructure requires education and research facilities, a population trained in scientific and technical disciplines, and communication systems—in short, a "knowledge industry" that generates and disseminates information. The knowledge industry typically receives relatively low priority in development planning because the immediate needs for food and employment channel most funds into agriculture and industry. Education systems provide rudimentary training for most people in simple facilities, while allowing a minority access to more complete and modern training and facilities. A standard feature of developing societies, then, is an "elitization" of information, with a concentration of schools, libraries, research centers, and technology in a relatively few and mostly urban centers, where the scramble is on for access to the most advanced data and information usually produced in developed countries (Saracevic *et al.*, 1985:194).

Because education levels are generally low and facilities are poor for most users, the information institutions that do exist experience low levels of use. Why go to the library to look for information if you can't read or if all the materials are 10 or 20 years old and out of date? The lack of interest in information has social and cultural roots as well. Most of the information explosion in the twentieth century consists of data and analyses that apply to large corporate environments or involve a fragmentation of language into categories that resonate with rational, bureaucratic purposes; most of the world's languages are not represented in this information, and in any case the subjects discussed and even the terms of reference are quite alien to the personal and family-oriented realities of most people in developing nations. In addition, the educational systems in most of the world stress rote learning of basic skills, and do not train students to look into information sources to solve problems or to gather data for productive purposes (Slamecka, 1982; 1985:181). So school dropout rates are high; most people do not go to libraries or use information services to gather the information useful for their lives. Low levels of patronage naturally discourage investment by governments, and the resulting poor levels of service reinforce the cycle of poverty. The cycle has destructive consequences for development, because with fewer users there are fewer specialists, and a low level of professional development in the knowledge industry. Ultimately, this contributes to more limited or slower access to relevant scientific and technical literature, less satisfying research and publish-

ing, and the exodus of top researchers to the developed world (Gray, 1983:84–86; Menou, 1983; Neelameghan & Tocatlian, 1985:160–61).

While developing countries wrestle with their own structural contradictions, the developed world presses on with technical and organizational changes that increase its power over information. Behind its power are universal educational systems that encourage scientific inquiry and the use of information services, the scientific and technical infrastructures that make use of the most up-to-date information and data-processing systems, and communication systems that allow the rapid transfer of data and information of all kinds to specialists as well as a mass market. The research and development efforts and large-scale investment programs of Japan and the United States have threatened Europe and the Soviet Union; the advanced sectors of developing nations always remain several years behind (Mackintosh, 1986:96–100, 122, 127). But from the perspective of the Third World, the real power of the developed economies lies in their ability to create and market products through large capitalist enterprises. The MNCs benefit from economies of scale in production to sell at lower prices, they offer the most advanced systems, and they make use of telematics infrastructures to obtain intelligence on markets within developing countries even before indigenous competitors. Telematics itself is a prime example of MNC dominance. In telecommunications, for example, about 20 MNCs produced around 95% of equipment amounting to 10–15% of the world output in engineering goods, with Third World demand in the late 1980s predicted at 30% of the total. Smaller developing countries are at the mercy of these giants and have little chance in the near future of developing their own electronics industries or telematics technology (Hobday, 1985:315–17; Sussman, 1988:285–94).

In the eyes of Third World leaders, the gross disparities in economic performance, research, and technology underlie a new imperialism that threatens to keep the less developed nations in a position of perpetual thralldom. The most dangerous threat is military; advanced weapons systems with microelectronic components and computers are concentrated in North America, The U.S.S.R., Western Europe and a few of the larger developing nations, rendering the majority of the world's nations vulnerable to armed intervention. On a strictly accounting basis, the attempt to purchase and install modern telematics systems for development purposes will keep many nations in debt to MNCs. Furthermore, to purchase equipment and know-how from foreign companies deprives local personnel of R&D opportunities, keeps installed equipment a generation behind, and starves local labor of employment. International information services and communications systems, beyond the control of Third World nations, perpetuate cultural hegemony as well, as the values of the West have greater opportunity for transmission and appear, in any case, as intricately connected with superior power (Nora and Minc, 1980:79–80; Stover, 1984:31–57; White and McDonnell, 1983:17–20).

Fears caused by the global disparities in information technology and access emerged during the mid-1970s in discussions of a "New World Information Order," with heavy criticisms of the contemporary network of global telematics that reinforces dependency relationships. The debate culminated in the MacBride Report to UNESCO in 1980 which attacked "information imperialism" and ultimately led the United States and Great Britain to withdraw from UNESCO. Concrete issues within this debate are transborder data flows and satellite broadcasts. Even the more developed nations have taken action to prevent the transfer of data outside their borders where legal restraints on its use may not apply; for developing nations the problem is more acute, for the superior research and telematics facilities of developed countries sometimes give MNCs and foreign governments a better view of the situation in a Third World country than its own government may have. Closely connected to this issue are proposed limitations on direct broadcast signals from satellites, which may provide tools for wealthier nations to beam social and cultural programs across borders and severely distort cultural or intellectual directions of poorer peoples. The Third World has even scored a victory in the technical area by successfully pressuring the U.N. International Telecommunications Union to allot every nation in the world a potential satellite orbital position and an electromagnetic spectrum bandwidth for

future transmissions. For the larger debate on the New World Information Order, there has been no agreement on the terms of the debate and few positive results have emerged (Stover, 1984:99–102; Mowlana, 1985:39–42, 48–49; Pavlic and Hamelink, 1985; Surprenant, 1987).

Opportunities for the production of the technical components and infrastructure for a national information system are limited for most developing countries. Japan, and then South Korea and Taiwan, did well by finding middle-level technologies where centralized coordination of investment and cheap labor allowed them to undercut the United States and Europe, but with increased automation worldwide even the East Asian nations will find that route more difficult in the future. There are formidable barriers to entry into the circuit/chip/hardware field, which is capital intensive, needs high technology, and already has big players. While the large developing countries may be able to subsidize their own industries in these areas, the smaller countries may have to accept long-term dependence on MNCs, but grasp opportunities for "leap-frogging" technological stages as new products enter the market. It is possible, however, that the technological gap is already so great, especially in the crucial areas of transmission and satellites, that most developing nations will simply be unable to participate on a competitive level in the information technology industry. As for provision of end-user technology such as the telephone, most Third World countries cannot afford the outlays for adequate expansion, and can barely keep pace with population growth (O'Connor, 1985:313–22; Agi, 1987:14).

Economic planners place information systems and technology within the services sector, directly or indirectly supporting manufacturing at various stages of production. The increasing integration of microelectronic components in factory automation, necessary for competitiveness and foreign exchange, highlights the need for information systems in the development of national manufacturing industries. The goal for Third World planners is to achieve some level of international competitiveness in services and thus manufacturing that supports national growth and a balance of payments without undue dependence on MNCs. Planning strategies differ on the degree of dependence that is possible or desirable—the continuum between open access to markets and national regulation. The variety of Third World strategies, ranging from outright purchase of telematics systems to export-oriented production of software and peripherals in export-processing zones, are generally undertaken in the expectation that technology transfer and skill acquisition will aid indigenous growth of a knowledge industry. The paramount issue, however, is employment—both in the short term through foreign-backed production facilities or in the long term through improvements in communications or education. Unfortunately, in the short term information systems development and high-tech production do not address the pressing needs of the majority of the population for basic necessities and employment, and instead accentuate the gap between urban elites and the vast masses or urban or rural workers (Castells, 1986: 325–32; Dadzie, 1988).

INFORMATION SYSTEMS DEVELOPMENT IN SOUTH ASIA

In this section I will briefly survey information technology and services in four South Asian countries: India, Pakistan, Bangladesh, and Sri Lanka. The purpose of this survey is to portray in more concrete terms the types of development in this area as a representative sample of Third World nations. The wide differences in political economy in these countries are mirrored in the quite different responses of economic planning and the levels of accomplishment in information systems development.

India is a large country with a population expected to reach one billion by the end of the twentieth century. The majority of those people are poor, and perhaps a third of the population lives at the subsistence level. But its size and population are an advantage, allowing the nation as a whole to muster considerable resources for particular development programs. In addition, the large group of the absolutely poor is balanced by large working and middle classes that possess the skills and training necessary for a modern industrial and technical society. Wide rural expanses still immersed in feudal relations exist along with pulsating urban environments; widespread illiteracy parallels a growing number of

world-class research establishments. The contradictions of India exemplify the situation in the larger developing countries, which are moving rapidly in some areas of society and economy, but leaving huge numbers of people behind. Thus, India is one of the world's most industrialized nations in absolute terms, and has a formidable defense industry as well as space technology, while great masses of peasants and workers enjoy few of the benefits of modernity.

Although it is predominantly a capitalist country, India's government has continued to espouse socialist goals, and state regulation of information industries is the norm. As part of its socialist programs, and in an attempt to protect its own industries, the Government of India has tried to implement a policy of "dissociation" from the global network of telematics (White & McDonnell, 1983:19). For example, until the mid-1970s, the Indian computer industry was dominated by IBM, but the Government demanded that IBM conform with regulations requiring Indian equity in their operations and control over currency transactions. IBM withdrew from India, leaving the field open for more pliable MNCs and for the government-owned Electronics Corporation of India Limited (ECIL), which filled demand into the 1980s. In the early 1970s the average lag time in computer technology between India and the West was 8.5 years, but by the early 1980s the gap fell to 2.6 years (Grieco, 1984:24–37, 87–98; Girdner, 1987:1189–1190). The collaborative agreements necessitated by regulations resulted in speedier technology transfer to India and the rapid dissemination of know-how to Indian entrepreneurs. During the 1980s, the rate of automation using microelectronic components in India's larger production facilities has been one of the highest in Asia outside Japan (*Automation Technology*, 1987:17–22).

In a similar vein, the Indian Telephone Industries Limited (ITI) has enjoyed a virtual monopoly over the telecommunications equipment field, but has collaborated with foreign firms for the adaptation of telephone technology to Indian conditions (Muralidharan, 1987:1064). Meanwhile, agreements with the United States and international aid agencies led to an efficient television satellite program by the mid-1970s, and an effective nationwide television system run by the central government by the early 1980s (Stover, 1984:89–91). Estimates of the growth of the Indian electronics industry during the Seventh Five-Year Plan (1984–89) conservatively projected almost a four-fold increase to U.S. $547 million (compared to 1983 production in Japan of $53.3 billion, in the U.S. of $144 billion) (S.M. Agarwal, 1985:279; Mackintosh, 1986:96).

Accompanying the undeniable advances in Indian telematics are a wide range of major problems. First, there are inefficiencies associated with centralized operations in the electronics industry: gross time delays in government granting of licenses; lack of coordination between production, research and development; favoritism for less competitive firms; preservation of 3000 small-scale electronics firms protected by law, totally inappropriate for economies of scale (S. M. Agarwal, 1985:285–89). The research community, relatively insulated from competitive timetables, has not demonstrated an ability to either create new products or to adapt foreign technology with speed before it becomes obsolete elsewhere. As a result, demand has increased much faster than supply for almost all telematics equipment (over 740,000 users are registered on the waiting list for telephones) and the Indian electronics industry as a whole lags about three generations (15 years) behind the cutting edge of research in the developed world (Girdner, 1987:1192). While the education system churns out huge numbers of graduates and Indian capitalism expands rapidly, the country appears to be bursting at the seams, straining to grow within the confines of its electronics industry.

In terms of information services, India has a long tradition following Ranganathan of remaining quite up-to-date in theory, and some projects underway in the 1980s operated at world-class level or were only a few years behind similar developments in Europe. For example, India's State Trading Corporation operates a well-informed intelligence unit equipped with modern telecommunication facilities to monitor and deal in edible oils (Dedijer & Jequier, 1987:155). The National Informatics Centre (NIC) started in 1977 under the Department of Electronics; it is linked to main computers in state capitals, in turn linked to hundreds of district-level computers through microwave earth stations and the Indian satellite system (INSAT). The NIC has also been instrumental in setting up com-

puter systems and databases for over 40 ministries and hundreds of projects (Banerjee, 1987:23, 142-53). Other major government agencies concerned with scientific and technological issues have been working since the late 1970s or the early 1980s to develop online data bases in their respective areas. The major national laboratories have their own sci-tech libraries that are relatively current with global research. The Indian National Scientific Documentation Center (INSDOC) in New Delhi accesses and promotes industrial and bibliographical information, while the National Social Science Documentation Centre (NASSDOC) in Delhi updates a regional union list and responds to bibliographic requests in the social sciences. The Seventh Five-Year Plan included an emphasis on the development of manpower for the establishment of a national information system. Contributing to this goal, 44 universities provide library education at the Bachelor's level and 17 at the Master's level (Saracevic, 1984:195; Lavakare, 1985; Agrawal, 1987; Agrawal & Lal, 1987:287-90; Kumar & Attri, 1987:390-95; Malhan, 1988:387-88).

A closer look at the provision of services for science and technology reveals severe limitations. The absence of a national Union List means that most researchers rely almost entirely on their own collections of materials, the holdings of their own laboratory's library, or an "invisible college" of personal contacts for recent literature. Many researchers have poor relationships with their librarians, who are typically poorly trained and underpaid. Despite a very large number of journals produced within India, a disproportionate number of references in articles point to European or American sources, and most researchers will attempt to publish their own work out of the country. The best facilities for obtaining information are concentrated in a handful of major research centers; those working outside those centers find it extremely difficult to keep up with current literature. Because most researchers operate through their own networks, the fledgeling national information networks remain underutilized. NASSDOC, a collection center for 100,000 volumes, receives only 400 requests annually for select bibliography, and INSDOC receives as many requests in a year as similar clearinghouses in Britain or the United States see in a single day. In library schools the trend to include information science components in curricula has been slow, with the vast majority of courses concerned with traditional library subjects (Saracevic, 1985:195; Agrawal & Lal, 1987:288,290; Malhan, 1988:391-92).

The information available to the public through public libraries or through educational institutions is often of poor quality. A handful of large cities have relatively large holdings and modern services. The National Library in Calcutta, founded in 1902, has 2 million volumes, bibliographic and documentation services, and interlibrary loan. The Central Reference Library in Calcutta is the site of the Indian National Bibliography and the National Book Exchange Center. Libraries with several hundreds of thousands of volumes exist in Bombay and Madras as well. The Delhi Public Library, started in 1951 with UNESCO aid, has 4 branches, 24 sub-branches, and mobile sections. But in the entire nation, these are the only places out of 29 metropolitan cities with public library systems. Only 15 out of 22 states have public libraries at central spots, and only half the towns in India have public libraries. The existing facilities are often run-down, poorly staffed, and full of outdated or irrelevant holdings. In sum, only 20% of the *literate* population in India has access to library resources.

At the level of higher education the story is the same. The major cities have at least one university where the library is well-organized, although the best collections tend to exist in departmental offices rather than the library. Quality declines rapidly in the college ranks. In a study of the public and private colleges of Kerala state, for example, Bavakutty found that most facilities were grossly inadequate, the staff poorly trained (none with MLS), most libraries had no catalogues, and average annual allocations were only 2.2% of the college budget. Since the average number of students was 1505 and the average number of library seats 25, it is not surprising that the vast majority of the students never patronize the library, but simply memorize appropriate sections of their textbooks (Bavakutty, 1984; S. P. Agrawal, *et al.*, 1985:294-95).

Information systems and service have experienced mixed progress in India, and the service per person is low, but as a nation, India stands as an island of progress among the countries of South Asia. Pakistan, with a small electronics industry, had made small prog-

ress toward the indigenization of telematics production by the early 1980s. For R & D purposes, the Pakistan Scientific and Technological Information Centre (PASTIC) was founded in 1957 with UNESCO support for the purpose of documentation provision, but it never became a center. Provisions existed in the Sixth Five-Year Plan (1984–89) for a national public library system, but little progress was made. The country had a total of 1261 libraries with 9,423,900 volumes for a population of approximately 84 million. Conditions in most institutions were poor, with good systems standing as isolated islands unconnected with each other. Only six universities offered two-year degree programs leading to an M.A. in Library and Information Science (Haider, 1986; Khurshid, 1987).

These limited programs were years ahead of those in Bangladesh, independent only since 1971, with a population of over 100 million in the late 1980s. There, an endogenous electronics industry is almost nonexistent, and a national information policy depends on foreign aid. The largest library in the country is the National Library in Dhaka, with 100,000 volumes. The entire country has 200 libraries, almost all in major towns, with collections averaging less than 15,000 volumes. National holdings during the 1980s totaled 300,000 for 22.5 million readers—one volume for 7500 people. There is an almost complete absence of trained professionals; those who work receive very low pay (Khan, 1984).

In Sri Lanka, the twin problems of a post-colonial economy and socio-political instability have had a decidedly negative impact on a promising knowledge industry. With a literacy rate of 87%, the highest in South Asia, the country was poised in the early 1980s for a breakthrough toward higher standards of living. But until that time the economy was tied to the export of primary commodities, especially tea. The greatest government efforts went into expanding the agricultural base through massive irrigation projects. The education system perpetuated a colonial pattern of training in the Liberal Arts, preparatory for careers in administration, while neglecting technical skills. Information services lagged significantly behind primary education. The National Museum Library, the national depository, held 600,000 publications; the main library of the University of Ceylon held only 300,000 volumes (Korale, 1984:120–23). As population (15 million in 1981; projected 18 million in 1991) began to outrun the economy, ethnic conflict between Sinhalese and Tamils and among Sinhalese political factions erupted into civil war, badly damaging planning efforts. So the country is a case study in incomplete development. Improvements in agriculture and education did not lead to the next stage—transition to a technical-industrial economy. The result was frustrated aspirations and political struggle.

South Asia as a region demonstrates several levels within the world's developing countries with quite different potential for the creation of national information systems and the utilization of microelectronics technology. Because of their continuing political crises and their poor resource bases amid rapid population increases, Pakistan, Bangladesh, and Sri Lanka have not been able to accumulate an adequate technical base in telematics, a sufficient cadre of trained professionals, or an information infrastructure that supports R & D as well as general information needs of the public. Bangladesh and Sri Lanka, with overwhelmingly agricultural economies, remain dependent on foreign sources, while Pakistan has created at least an embryonic national information industry. In comparison, India demonstrates the advantages of large size and relatively stable political conditions. There, the problem is a structural incongruity between demand and supply, with the educated and modern sectors of the economy consciously pushing for more information and access to telematics which the public sector has not provided fast enough. The Indian middle class, in fact, constantly pushes for the abolition of government controls and a "re-association" of the market with the global capitalist market, allowing the rapid import of technology, data and information to kick consumer use of electronics and information to new heights. They want phones, computers and current data now, for their own personal or business purposes, and they may not care about the ramifications for the economy as a whole.

During the 1980s, all nations in South Asia began to move toward increasing cooperation with MNCs and governments of OECD nations, in an effort to move their economies toward the service sector and knowledge industries. The governments of H. M. Ershad in Bangladesh, Zia ul Haqq, and Benazir Bhutto in Pakistan, and J. R. Jayawardane and Ranasinghe Premadasa in Sri Lanka steadily steered away from socialized

programs and favored policies of high-tech or middle-tech cooperation with developed nations. The government of Rajiv Gandhi, which came to power in India in 1984, implemented a "New Electronics Policy" designed to obtain telematics from the West, relax import restrictions, and decentralize both R & D and production (Girdner, 1987:1193–97). These policies are necessary for security purposes and future competitive potential, but could land the nations of South Asia in a new level of dependency on MNCs and foreign countries. The most unfortunate consequence of the new policies could be a heightened emphasis on meeting the needs of the middle classes, while ignoring the basic needs of the population as a whole. If one-third of a country enters an information age, it may not create a trickle-down effect for the remaining two-thirds of the people, but will leave them poor and disenfranchised—leading eventually to social upheaval. This is the tightrope all of the developing countries must walk.

SOLUTIONS

Until the 1970s, large institutions and centralized organization were seen as the main solutions for social problems. This vision affected the application of information to development problems. In the field of telematics, the MNCs planned a world-wide infrastructure of telephones, television and computers that would stimulate the exchange of ideas and thereby speed up development. International organizations such as UNESCO similarly pushed projects such as UNISYST, which aimed at global compatability of reference services and the free flow of information around the world as the basis for increasing communications. At the national level, the impetus from UNESCO's NATIS program and from developing nations as well was toward centralized national institutions such as clearinghouses and documentation centers that would collect and disseminate national and international information and thus stimulate communications and development.

Since the 1970s there has been an intellectual movement away from models of centralization and toward more pluralistic models of social and economic development. In the capitalist world, some conservative governments in the United States and Western Europe, as well as business ideologies, have stressed the role of private enterprise and undermined centralizing tendencies in the telematics field. The early plans for single, huge integrated computer systems have changed into separate implementations of data bases surrounded by multiple technologies. Similar movements toward decentralization as the next stage of socialist development have affected the planned economies as well—first China, then the Soviet Union and Eastern Europe. Among the developing countries, the movement away from world systems found expression in policies that demanded national control over telematics technology (as in Brazil and India) and challenged dependence on one or several large MNCs. Further evolution in the larger developing countries is pushing telematics industries away from nationalized monopolies toward a more competitive environment with multiple institutions for R&D and production. Similarly, as the earlier programs of UNISYST and NATIS as well as national information centers bore meager fruit for truly suffering populations, development trends have shifted toward encouragement of local and regional initiatives. In all these movements there has been no absolute decline in the power or size of centralized agencies anywhere in the world. The trend, however, is toward the multiplication of small and intermediate actors, the goal being the eventual emergence of compatible networks from a large number of discrete but more creative programs.

There have been some major success stories in the provision of information through large, centralized international organizations. For example, the World Weather Watch (WWW) provides a Global Data Processing System that receives input from 20,000 different stations and distributes output world-wide through the Global Telecommunication System. The International Information System for Agricultural Sciences and Technology (AGRIS) similarly provides central processing and decentralized input and output. The UNISYST program has effectively drawn up systems for interconnection standards for the transfer of reference material. (East, 1983:62–63; Neelameghan and Tocatlian, 1985:154–55). Recent literature stresses, however, that although such programs are essential, they should no longer constitute the major thrust of international development in the informa-

tion field. UNESCO led the way in 1976 with the reorganization of its information activities under the General Information Program (PGI). The second Medium-Term plan of PGI/UNISYST (1984–89) emphasized the introduction of modern technology into developing nations, but singled out users' needs and regional cooperation as major areas of emphasis (Neelameghan and Tocatlian, 1985:155–56).

The movement toward local projects is an attempt to overcome the cultural biases inherent in imported technology and to support information resources that will survive because they meet users' needs. One part of this process is the adaptation of portable or small-scale microelectronics technology to village or town environments where it reaches relatively small audiences but contains messages of relevance. An example is the growth of small radio stations serving the needs of peasant or small town populations with customized programming. Other options are slide projectors, audio and video cassettes produced locally and containing educational messages useful for health, education, and business. Weiss and Jarvis (1986–87) have suggested that interactive video disc offers great potential as a substitute for live instruction when instructors are rare and the students are many or scattered—especially useful for training in mechanical disciplines. The International Labor Organization (ILO) and other international agencies have funded generalized software packages for microcomputers, useful for development efforts in low-technology areas (Dosa, 1985:149; East, 1983:63). The reverse side of this approach is encouragement of local communication networks and information sources that already function through traditional or artistic channels, and "appropriate" technology applied to these sources in order to encourage greater local communication. The concentration on "group media" and decentralized communication media should be, according to some advocates, part of a larger policy of investment in rural areas and local autonomy, in contrast to the earlier models of (autocratic) control from the center and fascination with big, high-tech tools (White & McDonnell, 1983:15–17).

Some initiatives connected with the New World Information Order have attempted to break the Western monopoly of the knowledge industry by encouraging regional projects involving developing nations with much in common. In terms of database access, for example, Saracevic found in 1980 that a large percentage of scientific research relevant to developing countries came from other developing countries, although it formed but a small percentage of sources in Western-produced data bases (East, 1983:59–62). Similarly, news programs emanating from the developed world dominate the media, but contain little of relevance for the needs of developing nations. The proposed solutions have been:

1. regional meetings funded by UNESCO and other international organizations to plan regional networks for information exchange—systems described by the MacBride report as "collective self-reliance;"
2. joint efforts to create scientific and technological data bases appropriate for developing nations with common problems, rather than relying on linkages to extant global information services;
3. alternative news agencies oriented to Third World issues such as Interpress Service (IPS) or subregional agencies such as the Arab Union that concentrate on regional affairs (White & McDonnell, 1983:25–29; Dosa, 1983:316–17; Mowlana, 1985: 21–24.

The advent the South Asian Association for Regional Cooperation (SAARC) and other regional political bodies may form the framework for future Third World initiatives in telematics and information services.

Those development specialists who concentrate on information resources continue to stress the need for national information policies as absolutely necessary for a coordinated approach. The older literature in this vein concentrated on the national level as a vehicle for centralization of large networks, linked to the facilities of the MNCs or developed through centralized planning agencies, with the assumption that big institutions and global networks would, simply by existing and functioning, spur people to use them and thus participate in new development efforts. Certainly there are major roles for centralized direc-

tion: regulation of market and technology access through export-oriented industrialization that exploits growing internationalization of services in microelectronics and software; creation of national intelligence nodes or "analysis centers" for science and technology transfer; national "focal points" for integration with international services provided by UNESCO and other agencies (*Information for a Changing Society*, 1971; Kalman, 1983; Rada, 1983:48; Dedijer & Jequier, 1987:12–23; Dadzie, 1988:18). But the new focus of national information policies assumes that a multiplicity of information sources and active users within a nation are the prerequisite for the use of large networks and institutions. The crucial variables are indigenization of microelectronic technology, formation of new information institutions and services at local and intermediate levels as well as the national level, the introduction of new tools such as local, national and regional databases, and the training of new personnel in the field of information. The most crucial institutional transformation, according to some writers, is a major shift in education away from rote learning and toward problem solving; in the short term, it involves training in "Management of Information"—the importance of knowledge-based industries for national survival, and the policy options for developing nations of different size and potential (Slamecka, 1985:180–81). With a movement away from central control, these changes could lead to a qualitative change in society, an "open" or "transparent" environment that would support a modern knowledge industry and participatory democracy as well (Nora & Minc, 1980:126–41; Dedijer & Jequier, 1987:225–35).

CONCLUSIONS

Modern development processes revolve around the institutions dominant in the post-war world of the 1950s—the rational bureaucracy, the factory model, the nation state (including the newly-independent), the dynamic multinational corporation. These institutions stand behind the main vectors affecting and constraining development today, including hardware and software technologies and national programs. To a great extent, the tools, policies and programs associated with information systems in the 1990s appear to be dominated by the ageing structures created a half century earlier to perpetuate capitalist accumulation or, as in a mirror, to protect command economies from imperialism. Information systems function, then, as vehicles for the protection of entrenched elitism and privilege, reinforcing the disparities inherent in a world system that puts the poorer nations further and further behind. It is not a pretty picture when we observe the poorer nations of the world facing the transition from agrarian economies and feudal relationships to industrial systems, and the simultaneous challenge of movement to knowledge-based economic and social systems.

One of the profound contradictions of the late twentieth century is that the attempt to extend and consolidate power generates a radical decentralization. Because this process is driven in the leading industrial nations by electronic information systems and the quest for knowledge as a commodity, the field of information lies at the heart of a "post-modern" condition that affects the arts and sciences as well as economics (Lyotard, 1984:xxiii–6). In practical terms for development strategies, the leadership of capitalist as well as socialist economies seem to be in agreement that in an information-rich environment, coordination of many multivalent economic, political or social units is more effective than a hierarchical, directing role.

The changes in the global institutional and intellectual system have ramifications for Third World strategies. A short-term option already in use is to find niches in the local economy that fit into the diversifying global economy, and devote significant national sectors to the exploitation of those opportunities—an elitist, limited and perhaps shrinking possibility for many nations. A long-term option is to leap further, to push resources toward local or intermediate levels of social action and stimulate the growth of the many multivalent units that may more effectively generate and use socially valuable information. Here is where democracy, education, libraries, and telematics have major roles to play. Certainly the countries of the Third World are operating within severe constraints in choosing the long-term solution—external security and economic pressures demand a judicious

degree of central authority and "disassociation," and political instability results from the disestablishment of entrenched elites. There are indications, however, that international agencies as well as governments in the Third World are moving toward forms of decentralized technology diffusion and information access that can allow poorer peoples to compete in the twenty-first century.

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