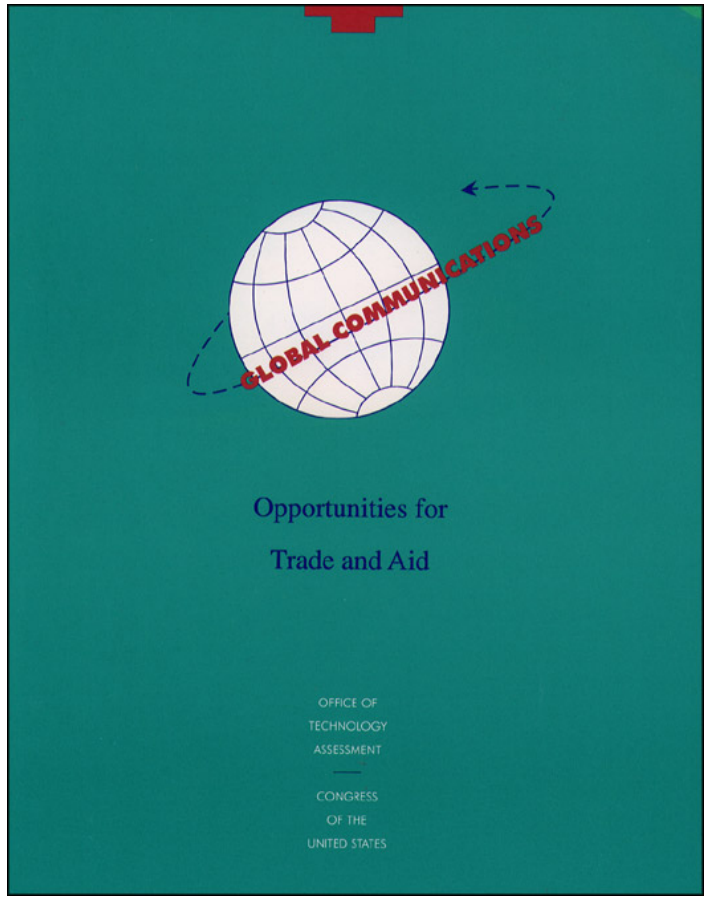
Global Communications: Opportunities for Trade and Aid

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Foreword

Global Communications: Opportunities for Trade and Aid examines the question of how telecommunication-related aid policies might be designed to support both United States trade and foreign aid goals. Communication and information technologies are particularly well suited in this regard. These technologies are of critical importance in today's knowledge-based global economy. Not only do they provide the networked infrastructure on which global businesses will increasingly take place; they also constitute one of the fastest growing sectors of world trade and investment. There is already mounting evidence and a growing appreciation of the positive role that information and communication technologies can play in supporting economic development.

By targeting poor and underserved areas, telecommunication-based aid programs have the potential to enhance U.S. trade opportunities in developing countries, and promote competition and telecommunications regulatory reform, while at the same time providing for the communities and people most in need. To lay the groundwork for developing an effective telecommunications-related aid strategy, the report examines the likely scenarios for the deployment of communication and information technologies in support of global trade; identifies the policy issues, market failures, and regulatory barriers that need to be overcome; and identifies and analyzes telecommunications-related foreign aid strategies that the federal government might pursue to address these problems.

OTA gratefully acknowledges the contributions of those who participated in the workshops and interviews; commented on drafts, and provided information, advice, and assistance. However, OTA bears the sole responsibility for the contents of this report.



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Summary, Findings, and Policy Strategies 1

In fiscal year 1995, the United States will spend approximately $12.6 billion for bilateral and multilateral international development and security assistance to serve a broad range of policy goals.[1] Many foreign assistance programs have encountered increasing resistance in the past few years for reasons that include the uneven record of previous programs; the rise of former recipients as major U.S. competitors; a questioning of the foreign aid rationale in the light of the collapse of the Soviet Union and the postwar security system, as well as more general concerns about the size of government and government spending.[2]

To ensure that foreign assistance programs serve the interests of the United States as well as those of developing countries, some policymakers are seeking to link aid policies more closely to national trade objectives. To this end, for example, the Peace, Prosperity, and Democracy Act of 1994 (S1856), which was introduced by the Clinton Administration in the 103d Congress, would provide U.S. businesses greater support for establishing markets in countries benefiting from U.S. aid. The Trade for Aid Bill (S722)—first introduced in the 102nd Congress, and subsequently revised and reintroduced in 1993—goes even further, making aid in some cases contingent on trade. This bill not only limits the amount of foreign aid that can be provided in the form of cash transfers; it also requires that more funding be targeted for capital projects, which generally have the greatest payoff for American businesses and workers.

Communication and information technologies are particularly well suited to mutually serve foreign aid and trade goals. These technologies are of critical importance in today's knowledge-based global economy. Not only do they provide the networked infrastructure on which global business will increasingly take place; they also constitute one of the fastest growing sectors of world trade and investment.

There is already mounting evidence, and a growing appreciation of the positive role that communication and information technologies

[1] U.S. Agency for International Development, *Congressional Presentation, Summary Tables, Fiscal Year 1996*.

[2] Anne O. Krueger, *Economic Policies at Cross Purposes: The United States and Developing Countries* (Washington, DC: The Brookings Institution, 1993); See also *Foreign Aid Reform: Hearings Before the Subcommittee on International Economic Policy, Trade, Oceans and Environmental Affairs of the Senate Committee on Foreign Relations* (Washington, DC: U.S. Government Printing Office, 1994).

can play in supporting economic development.[3] These technologies have proven extremely useful not only in promoting and sustaining economic activities of all kinds, as well as in enhancing human potential—a key ingredient for the success of any development program.

The value of networked information technologies for economic growth and development will probably loom even larger in the future, given a more service-oriented global economy in which production and marketing activities are distributed on a world-wide basis.[4] In preparation, many developing countries are currently looking to communication and information technologies to help them bypass the long and arduous process of industrialization, allowing them—straight away—to become providers of global information services.[5] In contrast, developing countries that fail in these new circumstances to keep pace with the advance of technology, and to integrate their communication systems into worldwide business networks, will probably be left yet further behind.

The capabilities of information and communication technologies are also expanding to support development goals. For example, advanced satellite systems—such as low earth-orbiting satellites—will soon be able to provide sophisticated voice and data services on a global and, hence, more cost-effective basis. In addition, because communication systems are increasingly driven by software, their components can now be unbundled from the network to allow network users much greater flexibility and control.[6] As a result, communication networks can be recast and customized to meet the specific and, more often than not, varied needs of developing countries.

If developing countries are to take advantage of information and communication technologies to support development, however, they will need considerable foreign capital and expertise. In many developing countries, existing infrastructure is very primitive, providing in some extreme cases only one telephone per 1,000 persons. And the cost of upgrading these communication networks can be astronomical—on the order of $60 billion to $80 billion according to some estimates.[7] Compounding the problem, many developing countries have only limited access to the foreign exchange required to purchase up-to-date equipment and services in the global market.

In today's increasingly liberalized, global telecommunications marketplace, many developing countries' communication needs can be met by the private sector. Already, many firms are eagerly competing to invest in and/or partner with developing countries to serve their rapidly growing communication markets. U.S. firms are especially well positioned in this regard. They are foremost in the development and deployment of communication and information technologies, and principal players in the information and communication technology and services trade arenas.

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[3] Robert J. Saunders, Jeremy J. Warford and Bjorn Wellenius, *Telecommunications and Economic Development* (Baltimore, MD: The Johns Hopkins University Press, 1994); see also Seth W. Norton, "Transaction Costs, Telecommunications, and the Microeconomics of Macroeconomic Growth," *Economic Development and Cultural Change*, vol. 1, October 1992, pp. 175–196.

[4] Fernando Henrique Cardoso, "North-South Relations in the Present Context: A New Dependency," in Martin Carnoy, Manuel Castells, Stephen S. Cohen, and Fernando Henrique Cardoso (eds.), *The New Global Economy in the Information Age: Reflections on Our Changing World* (University Park, PA: University of Pennsylvania Press, 1993); See also Bruno Lanvin (ed.), *Trading in a New World Order: The Impact of Telecommunications and Data Services on International Trade in Services* (Boulder, CO: Westview Press, 1993); and U.S. Congress, Office of Technology Assessment, *Electronic Enterprises: Looking to the Future*, OTA-TCT-600 (Washington, DC: U. S. Government Printing Office, May 1994).

[5] See, for instance, "Salinas' Rush for 'Bypass' Technologies," *Satellite Communications*, December 1992, p. 20.

[6] Unbundling refers to the ability to separately purchase communication functions and services that were formerly available only as a single unit. For a discussion, see U.S. Congress, Office of Technology Assessment, *Critical Connections: Communication for the Future*, OTA-CIT-407 (Washington, DC: U.S. Government Printing Office, January 1990), chap. 3.

[7] According to the ITU *World Telecommunications Development Report*, it will cost $58.3 billion to provide basic communications infrastructure to most nations. The World Bank estimates the cost to be even greater, totaling $80 billion. Steven Tisch and John Williamson, "World Conference Pushes for Policy Changes," *Telephony*, Mar. 28, 1994, pp. 9, 17.

This private-sector, trade-oriented approach to deploying technology for economic development serves today as the driving force behind the Clinton Administration's vision of the Global Information Infrastructure (GII). Speaking in March 1994 at the World Telecommunications Development Conference in Buenos Aires, Vice President Gore called on all of the world's leaders to adopt a global vision of the information highway. A global infrastructure based on private sector initiatives will, according to Gore, not only foster economic growth and development; it will also promote political stability, social improvement, and the spread of democracy.[8]

Some government incentives will probably be required, however. Although new technologies have considerable potential to improve social, economic, and political conditions across the globe, such an outcome is far from certain. How and to what purpose these technologies are developed and deployed will depend on more than the characteristics and capability of the technology; also important will be the social, economic, and political forces driving the technologies' deployment and use.

If, for example, developing countries are to employ information and communication technologies to improve their social and economic well being, access to advanced technologies will not be enough. For real technology transfer to take place, they must have the knowledge and hands-on expertise required to take full advantage of new technologies. Similarly, if communication technologies are to have a democratizing impact, they must be widely shared so that the power of the dominant groups in society is effectively counterbalanced by the power of those in subordinate positions. It must also be stressed that, although communication is sometimes viewed as a means of reducing conflict, it can just as easily serve to destabilize political situations and/or exacerbate conflicts among people of different origins and cultures.[9]

Thus, despite the growing availability of private investment for infrastructure deployment in developing countries, foreign assistance can still play a complementary—but nonetheless—pivotal role. Foreign aid programs can be targeted to address specific market failures and to create appropriate incentives to ensure that technology deployment is carried out in a way that promotes economic development, democracy, and greater political stability.

If the U.S. government is to use foreign aid to provide appropriate incentives, it will need a clearer understanding of the opportunities and problems associated with the deployment of communication and information technologies, as well as of the technical, political, economic, and social conditions required for their optimal use. This assessment seeks to contribute to such an understanding. Examining the probable scenarios for deploying communication and information technologies in support of global trade and economic development, it identifies the policy issues, market failures, and institutional barriers that need to be overcome. In addition, it identifies and analyzes telecommunications-related foreign aid policy strategies that the federal government might pursue, which are designed to address these problems.

REQUEST FOR THE STUDY

This study was requested by the U. S. House of Representatives' Committee on International Relations. In its letter of request, the committee asked OTA to conduct a study that would provide a conceptual framework for assessing the tradeoffs between U.S. trade policy with respect to communication and information technologies and services and the U.S. foreign policy objectives of promoting international stability, economic development, democratization, and nation-building. In addition, OTA was asked to identify the extent to which, and how, foreign aid policies might be structured so as to reconcile potential conflicts between trade and foreign policy goals while at the same time improving the efficiency and effectiveness of U.S. foreign assistance.

[8] Steven Tisch, "Gore Urges Ambition for Global Telecom," *Telephony*, Mar. 28, 1994, pp. 10–11.
[9] Samuel P. Huntington, "The Clash of Civilizations," *Foreign Affairs*, summer 1993, vol. 72, No. 3, pp. 22–50.

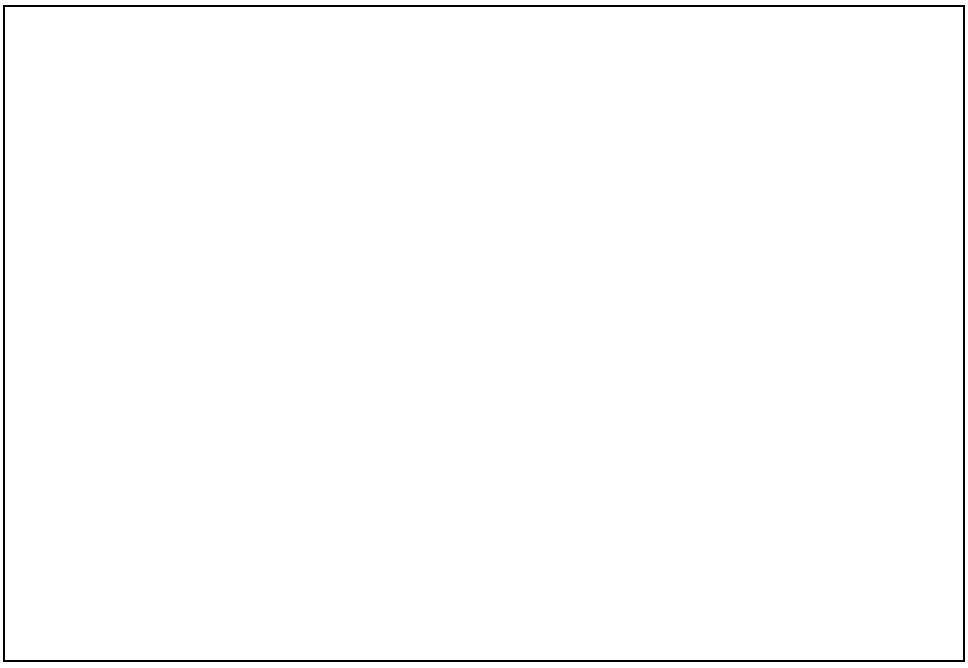
SCOPE AND ORGANIZATION OF THE REPORT

Advances in communication and information technologies can help developing countries to cope better with their domestic social and economic problems and to become more fully integrated into a global economy. The United States has much to gain from the Third World's success in this regard. Already, developing countries constitute one of the fastest growing markets for trade in telecommunications and information technologies and services, and the rapid deployment of these technologies will open up economic opportunities in other sectors as well.

One way of fostering such a mutually beneficial outcome is to develop foreign aid programs that incorporate a telecommunications component. Whether or not such programs will be successful, however, will depend on three major factors: 1) the overall design and effectiveness of aid programs; 2) the "fit" between the design and capabilities of communication technologies and the needs of developing countries; and 3) the effectiveness of the global market in diffusing information and communication technologies on a worldwide basis. As depicted in figure 1-1, by examining each of these three sets of factors, and relating them to one another, it is possible to identify a number of criteria for successful telecommunications-related aid policy strategies, and to develop policies that meet these criteria.

This conceptualization forms the basis for the scope and organization of this report. This chapter, chapter 1, lays out the findings, criteria for making policy choices and strategies to meet these criteria. Chapter 2, "Foreign Aid Policy: The Lessons Learned," describes the basis for a sound foreign aid policy. Chapter 3, "Communication Technologies to Promote Foreign Aid Goals," outlines technology characteristics and capabilities as they relate to developing country needs; and chapter 4, "Technology Diffusion in a Global Market Place," examines the effectiveness of the market in deploying telecommunication and information technologies on a worldwide basis.

FIGURE 1-1: Organization of the Report



SOURCE: Office of Technology Assessment, 1995.

KEY FINDINGS

A Continued Role for Foreign Aid

As the leader in an increasingly integrated global order, the United States has a vital stake in promoting democracy, sustainable growth, and political stability worldwide. This stake will probably loom even larger in the future. Just as national boundaries are increasingly penetrable to the flow of commerce, ideas, and people, so too these boundaries will no longer constrain the spread of political, economic, and environmental problems. Foreign assistance provides a key foreign policy tool for addressing such problems, and it will continue to do so in the future. The role of foreign aid will also loom larger in generating new opportunities for trade. Today, Japan and many newly industrialized countries are competing for developing-country markets not solely on the basis of their products; increasingly they are promoting their own model of economic development, which—if replicated by Third World countries—will lay the groundwork for establishing closer trading relationships.

The euphoria that accompanied the demise of the Soviet Union and the Communist regimes in Eastern Europe has, of late, been dampened considerably. Instead of signaling a new era of greater peace and security, these events were a prelude to the collapse of the social order in many countries, where authoritarian regimes were replaced not by democracy but by ethnic conflicts and civil wars. Included among these outbreaks of violence, for example, have been civil wars in Afghanistan, Somalia, Rwanda and Bosnia as well as ethnic conflicts in India, Iraq, Liberia, and Sri Lanka.

These events have led to a continued, if not expanded, U. S. military presence in the world.[10] Operating under the auspices of the United Nations, the United States has become involved in a growing number of peacekeeping operations. As compared to 1988, when the United Nations was engaged in five such operations, peace-keeping troops are today deployed in 16 locations.[11] During the same period, the number of military personnel deployed has increased from 9,570 to 62,333, while the United Nations annual peacekeeping budget has grown from $230 million to approximately $3.6 billion.[12]

Deteriorating social and economic conditions in many Third World countries do not bode well for a better future, at least in the short and medium terms. Over the past three decades, income disparity across the globe has doubled. Now, the richest 20 percent of the world's population receive an income that is 150 times the amount received by the poorest 20 percent.[13] Nearly 35 percent of the world's adult population are, moreover, illiterate. In addition, infant mortality rates continue to hover at 114 deaths per 1,000 live births.[14]

Economic progress in many developing countries is far from adequate to address these thorny problems. In the area of sub-Saharan Africa—where these problems are the gravest—only marginal improvements in per capita income and consumption are anticipated, even under the most positive growth scenarios.[15] Assuming a less favorable global economic environment, a number of Latin American countries will probably also experience difficult times. Continued unrest in the Soviet Union and Eastern Europe would make economic growth in this region problematic as well (see table 1-1).

The short-term steps that many developing countries are taking to relieve their immediate social and economic problems could complicate, or even jeopardize, their prospects for long-term sustainability. For example, in some cases, there

[10] David C. Hendrickson, "The Recovery of Internationalism," *Foreign Affairs*, September/October 1994, vol. 73, No. 5, p. 41.

[11] Boutros Boutros-Ghali, "Peacemaking and Peacekeeping for the Next Century," *Vital Speeches of the Day*, Mar. 15, 1995, vol. 61, No. 11, pp. 322–324.

[12] Ibid. In FY 1994, Congress appropriated $401,607 million for current peacekeeping operations. See Mark M. Lowenthal, *Peacekeeping and U.S. Foreign Policy: Implementing PDD-25*, Congressional Research Service, IB94043, updated Sept. 23, 1994.

[13] *Human Development Report 1993* (New York, NY: United Nations Development Program, 1993), p. 11.

[14] Ibid., pp. 11–12.

[15] *Global Economic Prospects and the Developing Countries* (Washington, DC: The World Bank, 1994), pp. 1–7.

TABLE 1-1: Developing Regions: Growth of Real GDP
(percentage changes per year)

	Trend	Recent estimates	1994–2003	
Developing region	**1974–90**	**1991–93**	**Forecast**	**Low case**
All developing countries	3.4	0.9	4.8	3.6
Sub-Saharan Africa	2.1	1.7	3.9	2.4
Middle East and North Africa	0.9	3.0	3.8	3.2
Europe and Central Asia (ECA)	3.1	-9.8	2.7	1.5
South Asia	5.0	3.5	5.3	4.2
East Asia	7.3	8.3	7.6	7.1
Latin America and the Caribbean	2.5	3.2	3.4	0.8
Memorandum item				
All developing countries, excluding ECA	3.5	4.6	5.2	4.0

SOURCE: *Global Economic Prospects and the Developing Countries*, A World Bank Book, 1994.

has been excessive cropping, grazing, and timbering in areas that are already extremely fragile from an ecological standpoint (see table 1-2).

Population growth and per capita income growth will put new strains on the global environment. In 1960, for example, the world's population was about 3 billion. Today it stands at 5.3 billion, and—based on a midrange forecast—it could increase by 70 percent to roughly 9 billion by 2030. Moreover, if global per capita incomes increase at an estimated rate of 80 percent, world economic output could grow to as much as $69 trillion, 3.5 times more than at present.[16] If pollution keeps pace with this projected development, the environmental damage could be astronomical.

Trends such as these not only affect the long-term sustainability of the international environment; they give rise to more immediate, international political problems, as well.[17] Faced with such overwhelming odds, governments in developing countries may well lose their capacity to govern and to provide essential services. If the social order breaks down as a result, people, instead of cooperating to help one another, may seek support from competing tribal leaders and local warlords, whose only mainstay is violence and the use of force.[18]

As the United States tries to cope with these kinds of problems, it may find that foreign aid, conceived of as a long-term preventive measure, is often its best recourse. Disputes involving social mores, ethnic tensions, and farming practices—which are generally not politically defined—are much less amenable to international negotiation than problems such as boundary disputes and disarmament agreements. Nor can the United States routinely resort to economic sanctions and armed intervention, given that such action will probably lead to further disintegration of civil society. Withdrawing into isolationism is also not a realistic option. Such an approach will entail a number of opportunity costs so that, if problems persist, the United States may be faced with far more serious threats in the future as well as less favorable options for dealing with them.[19]

[16] Developing country per capita incomes are estimated to grow by 140 percent. Calculated from data contained in the World Bank, World Development Report, 1992 (Washington, DC: World Bank, 1993).

[17] See Robert D. Kaplan, "The Coming Anarchy," *The Atlantic Monthly*, February 1994.

[18] Lester R. Brown, "Nature's Limits," in Lester R. Brown et al. (eds.), *State of the World 1995: A World Wide Institute Report on the Progress Toward a Sustainable Society* (New York, NY: W.W. Norton Co., 1995).

[19] Richard M. Haas, "Paradigm Lost," *Foreign Affairs*, January/February 1995, vol. 74, No. 1, p. 50.

TABLE 1-2: Estimates of Environmental Damage in Selected Countries

Country and Year	Form of Environmental Damage	Annual Costs as a Share of GNP
		(percent)
Burkina Faso (1988)	Crop, livestock, and fuelwood losses from land degradation	8.8
Costa Rica (1989)	Deforestation	7.7
Ethiopia (1983)	Effects of deforestation on the supply of fuelwood and crop output	6.0–9.0
Germany (1990)[1]	Pollution damage (air, water, soil pollution, loss of biodiversity)	1.7–4.2
Hungary (late eighties)	Pollution damage (mostly air pollution)	5.0
Indonesia (1984)	Soil erosion and deforestation	4.0
Madagascar (1988)	Land burning and erosion	5.0–15.0
Malawi (1988)	Lost crop production from soil erosion Costs of deforestation	1.6–10.9 1.2–4.4
Mali (1988)	On-site soil erosion and losses	0.4
Netherlands (1986)	Some pollution damage	0.5–0.8
Nigeria (1989)	Soil degradation, deforestation, water pollution, other erosion	17.4
Poland (1987)	Pollution damage	4.4–7.7
United States[2] (1981)	Air pollution control	0.8–2.1
(1985)	Water pollution control	0.4

[1]Federal Republic of Germany before unification.
[2]Measures the benefits of environmental policy (avoided rather than actual damages).

SOURCE: "Environmental Damage Robs Countries' Income," *World Bank News*, March 25, 1993, based on David Pearce and Jeremy Warford, *World Without End* (Washington, DC: World Bank, 1993).

An isolationist policy might similarly have negative opportunity costs in terms of trade. These costs will probably increase in the future insofar as developing countries are now driving worldwide economic growth. The 16 largest developing economies are now expected to grow at an average annual rate of 6 percent, twice that of the mature economies of North America, Japan, and Europe.[20]

The Japanese have already proven to be particularly successful in exploiting the commercial benefits associated with aid to developing countries, and they are becoming increasingly more sophisticated in their approach. Now the world's largest donor country—with contributions totaling $11.26 billion in 1993—Japan has recently moved to broaden its assistance programs to focus more on environmental, population, and healthcare goals.[21] Instead of using tied aid to promote its commercial ends, the Japanese are leveraging their own economic development model, in the hope that trade will follow the path of shared research, training, technology transfer, and personal exchanges. Not surprisingly, therefore, much of Japan's aid is centered in Asia, which is fast becoming Japan's largest market.[22]

The Need for More Cost-Effective Approaches to Providing Foreign Aid

If foreign aid policy is to better serve U.S. foreign policy goals and objectives, adjustments and innovative approaches are called for to assure that aid programs are more cost-effective. The

[20] "Global Growth Is on a Tear," *Fortune*, Mar. 20, 1995, p. 108.
[21] Hiroshi Hirabayashi, "Changes in the International Environment and the Direction of Japan's ODA," *Japan 21st*, vol. 39, No. 12, December 1994, pp. 23–27; and Peter Evans, "Japan's Green Aid," *The Chinese Business Review*, July/August 1994, pp. 39–43.
[22] Jonathan Friedland, "The Regional Challenge: Asia has Become Japan's Biggest Market," *Far Eastern Economic Review*, June 9, 1994, pp. 40–42.

success rate of aid programs will probably be improved to the extent that they are designed around a more flexible and holistic approach that can reconcile multiple goals and fully incorporate the wide ranging lessons garnered from past experience.

Over the past 50 years, the United States has employed foreign aid to achieve a variety of national goals. Aid has been provided, for example, for humanitarian reasons; to promote worldwide security and political stability; to support economic development and growth in trade; to maintain the integrity of the international monetary system as well as to foster democracy and protect the environment. To achieve these ends, the United States has employed a number of different policy tools. Included among these, for example, are direct monetary grants and grants-in-kind for humanitarian purposes and basic human needs, military assistance, emergency funding to support exchange rates in times of financial crisis, grants and loans for special capital/infrastructure-related projects, funding to insure private sector investments against excessive risks, etc. These tools have been used, moreover, by a wide range of aid organizations—public, private, national, regional, and/or multinational.

Developing appropriate foreign policies to address today's global challenges can benefit greatly from the lessons derived from this experience (see chapter 2). The case of the Marshall Plan is particularly instructive, given its fundamental success. What distinguishes the Marshall Plan experience from subsequent aid programs is the extent to which aid policy tools were tailored—whether purposefully or not—to the situation at hand. Equally important was the degree to which policy tools served to reinforce multiple foreign aid goals (see table 1-3).

Thus, for example, the U.S. decision to make aid contingent on European structural economic reforms was coupled with changes in the U.S. economy as well as to the broader revision of the international monetary system. Similarly, the transfer of financial capital to Europe was linked to the prospect of future U.S. trade opportunities there. Likewise, postwar defense arrangements in Europe served not only to protect the West against the Soviet threat; they also promoted regional political stability, so that Western European governments could focus their attention on cooperation and economic growth.

Today's situation is considerably less conducive to success (see table 1-3). Trade policies are now intensely competitive; fewer resources are available for aid; the United States and other donor countries are increasingly preoccupied with domestic issues; the goals of the United States and recipient countries (as well as other donor countries) are often in conflict; recipient countries lack the political and social resources to fully benefit from aid; etc.

Drawing on the lessons of the past in the light of present conditions, table 1-3 identifies the policy challenges that the United States faces in developing a more cost-effective foreign aid policy, and identifies a number of policy strategies that, when joined together into an integrated package, might provide a more suitable model for existing conditions in developing countries today.

In the past several years, foreign assistance programs have focused, for the most part, on structural economic and state administrative reforms. Although such programs are undoubtedly needed, they are hardly sufficient. For both democracy and free markets to thrive, what is required is not simply the establishment of free markets and strong, competent governments. As a growing body of evidence makes clear, equally if not more important are social and cultural institutions that foster trust and cooperation.[23] Trust and cooperation constitute a form of

[23] Robert Putnam, *Making Democracy Work* (Princeton N. J.: Princeton University Press, 1993). See also Fred Block, *Postindustrial Possibilities: A Critique of Economic Discourse* (Berkeley, CA: University of California Press, 1990), pp. 41–42.

Key Factors	Status of World Economic Regulation	Quantity and Allocation of Resources Devoted to Aid Programs	National Support/ Perceived Stakes Involved
Marshall Plan	Expanding trade in the context of trade liberalization and internationally coordinated post-War monetary system	High levels of mutually reinforcing financial and military commitments were focused on Europe The U S spent $554 billion (an average of $13,8 billion in 1981 prices), Joint participation in defense arrangement with the formation of NATO	Stakes were perceived as very high and linked to the notion of containing the Soviet threat. President Truman's Four Point Program provided a vision to sustain political support for aid
Today's Context	Increased integration and interdependence in global economy, driven by growth in trade, translational corporations and financial institutions Aggressive trade policies to capture big emerging markets Trade liberalization accompanied by new forms of protectionism Strain on post-War international monetary system	Dollar amount of economic aid in the aggregate is equivalent to the Marshall-Plan era, but resources are spread more thinly and unevenly Areas requiring economic aid are not necessarily the same as those requiring military assistance A large proportion of U S assistance focused on strategically important areas such as Egypt and Israel	Shift in concern from international issues to domestic problems — growing Federal debt General questioning of the cost-effectiveness and success of aid programs
Today's Policy Challenge	Incorporate developing countries into the global economy with win-win outcomes for all.	Develop more cost-effective ways to promote aid goals.	Greater vision for aid policy that better relates to present U.S. priorities and concerns (i. e., trade)
Today's Policy Criteria	1) Develop mutually beneficial trade agreements 2) Aid to support global economic institutions in developing countries –- i.e. standards financial markets, infrastructure privatization regulatory reform	1) Leverage across programs and agencies 2) Gain economies of agglomeration by focusing comprehensive programs more locally	1) Global exchange programs. 2) Involvement of business and other key groups m executing aid programs

TABLE 1-3: Criteria for Successful De

Donor/Recipient Relationship	Social/Political/institutional Context of Recipient Countries	Measurability of Success/ And Feedback	Key Factors
Aid to Europe provided on a quid-pro-quo basis involving economic reforms and European regional cooperation But U S and Europe were in basic ideological agreement about post-War priorities and institutions Europeans negotiated and helped design the structure of the Marshall Plan	A shared common history and continuity of political and economic institutions and a socioeconomic infrastructure was capable of absorbing and efficiently allocating aid resources	Aid programs fostered both economic and security goals and were perceived as being highly effective Because of its widely acclaimed success, the Marshall Plan served as the inspiration for U S bilateral aid to developing countries	Marshall Plan
We-They attitude persists as a result of debt crisis when donors imposed conditions on aid recipients Developing countries are now more inclined toward liberalization and greater integration into the world economy, but many find Asian development model more appealing than U.S. version	Diverse settings weak institutional frameworks, problems of political disorder and social upheaval	Few concensus measures of success. General perception of poor performance and failure of aid to have an impact Inadequate feedback mechanisms to achieve aid accountability and Improve development models	Today's Context
Find ways to negotiate aid agreements that enhance donor-recipient cooperation and that are mutually responsive to both sets of needs	Develop comprehensive aid programs that foster social/politlcal institution-building without undermining economic reforms	Enhance our understanding of the development process and develop qualitative and quantitative measures to better evaluate aid programs	Today's Policy Challenge
Revitalize existing forums or establish new forums that cut across G7/G66 boundaries where aid conditions can be negotiated in the context of joint interests	Incorporate into aid policies mechanisms to foster cooperation that build on existing cultural strengths and social networks	1) Experiment with small, innovative pilot projects **2)** Develop databases and networks for collecting and disseminating aid-related information and results	Today's Policy Criteria

SOURCE: Office of Technology Assessment, 1995.

"social capital" that supports both free markets and democracy, while serving at the same time to better balance the relationship between them (see chapter 2).

Many developing countries have minimal "social capital" on which to build either efficient markets or sustainable democracies. Their political cultures are characterized not by mutual respect and reciprocity but, rather, by distrust and alienation.

Foreign assistance programs might be specifically designed to counter this atmosphere, fostering community interaction and a basis for local cooperation. Building trust is a problem of collective action, so generating it is no simple matter. Living in a society devoid of goodwill, people fail to act in mutually beneficial ways, even when it is in their own best interest. This situation is a classic example of what economists call the "prisoner's dilemma." Each person holds back, fearing that—if he or she is the first to act honestly—others will surely take advantage. Once started, however, cooperation tends to be self-sustaining.[24] Thus, foreign aid investments in cooperative behavior can, if successful, have a high payoff. Over time, policies that promote cooperation can help to generate the social capital that is required for both free markets and democratic politics. This social capital can also be drawn on to maintain government stability in future times of trial (see chapter 2).

▮ Leveraging the Unique Role of Communication Technologies

Communication and information networking technologies are uniquely suited to support economic development, democracy, and political stability in the Third World, because communication is inherent in all these processes. These technologies serve not only to sustain social processes; equally important, they mediate and structure social activities. Thus, if communication technologies are to prove effective, they must be well matched to the tasks at hand. Depending on their design and capabilities, and the social and economic context in which they are deployed, communication technologies can be used either to promote or hinder U.S. foreign aid goals.

The development challenges facing Third World countries today are monumental. Unlike the countries of Western Europe, developing countries do not have the luxury of executing the processes of nation-building, economic growth, and democracy in a sequential fashion, spread out over centuries.[25] Instead, these three processes must be carried out simultaneously, even though they are not always mutually reinforcing.[26]

Compounding their problems, developing countries must deal with these challenges in an open, and increasingly networked, global economy. To be successful in such an environment, they must become further integrated into the world economy. Yet, by being more open, these countries run the risk that international players, with agendas of their own, could undermine their efforts at nation-building by competing for economic resources as well as political and cultural loyalties.[27]

Third World resources to meet these challenges are severely limited, especially in the least

[24] See Robert Axelrod, *The Evolution of Cooperation* (New York, NY: Basic Books, 1984).

[25] For discussions of the implications of sequence see, E.A. Nordlinger, "Political Development, Time Sequence, and Rates of Change" in Jason L. Finkle and Robert W. Gable (eds.), *Political Development and Social Change* (New York, NY: John Wiley and Sons, 1971), pp. 455–471; and Leonard Binder, James S. Coleman, Joseph La Polembara, Lucien Pye, Sidney Verba, and Myron Weiner (eds.), *Crisis and Sequence in Political Development* (Princeton, NJ: Princeton University Press, 1971).

[26] Thus, for example, democracy and political stability are not, as has generally been believed, highly correlated. Statistical evidence shows that, in becoming mature democracies, countries experience a difficult transition, when mass politics tends to exacerbate nationalism and national aggression. See Edward D. Mansfield and Jack Snyder, "Democratization and War," *Foreign Affairs*, vol. 74, No. 3, pp. 79–80.

[27] For a discussion of the relationship between local political participation and globalization, and its effect on the nation state, see Zdranko Mlinar, "Local Response to Global Change," *Annals of the American Academy of Political Science*, July 1995, No. 540, pp. 145–156.

developed countries.[28] Having yet to recover from the debt crisis of the 1980s, many countries continue to experience low growth rates, with the average for all developing countries ranging between 1.4 and 1.6 percent.[29] Consequently, they have minimal capital at their disposal to invest in improvements of any kind. Not surprisingly, therefore, despite deteriorating infrastructure, high rates of illiteracy, and highly inadequate health care, the less developed countries also have the lowest per capita investments in such areas.

Communication and information technologies, as they are advancing today, can make a critical difference in determining Third World success or failure. Ideally, these technologies can serve not only to foster economic development, democracy, and political stability, but also to balance these processes, so as to make them more mutually reinforcing. Moreover, they can help developing countries reinforce national and local community ties while at the same time fostering their global integration.

Table 1-4 lays out this interrelationship between today's technology advances and changes in social processes. Column 1 describes technological trends and the technology developments reinforcing them; column 2 lays out the technological implications of, and the new applications that result from, these trends; while column 3 identifies their potential social, economic, and political impacts (see chapter 3).

In examining this table, it is important to note that it is the new capabilities and applications made possible by advanced technologies that engender social, economic, and political impacts, and not the technologies or the trends themselves. Secondly, it is necessary to recall that technologies are not neutral with respect to their outcomes. Different trends give rise to different impacts, all of which must be understood.

Technology Applications for Economic Development

As can be seen from table 1-4, advances in communication technology can foster economic development in a variety of ways. If, for example, developing countries take advantage of greatly improved cost/performance ratios to deploy communication and information technologies on a national basis, they can increase the size and efficiency of their markets as a result of lower, information-related transaction costs. This possibility is very important for developing countries where, in some cases, markets do not exist for lack of information. Many developing country markets are characterized by imperfections of institutions, structures, and operations, so that economic signals and incentives fail to reflect the "real costs" of commodities or factors of production (see box 1-1).[30] There will also be productivity gains, because larger, better integrated markets will allow Third World businesses to gain greater economies of scale and scope—a benefit that was not available to them, in most cases, until now.

The trend towards decentralized intelligence throughout communication systems will also give rise to economic benefits. Within developing countries, there is a lack of people with mid-level skills required for knowledge workers and middle management. Nor is there an adequate commercial and legal structure—such as banks, insurance companies, commercial lawyers, and stock companies—to permit Third World companies to effectively exploit many new business possibilities. With the type of interactive, intelligent information systems that decentralized intelligence allows, businessmen in developing countries can access the required information services via technology. Intelligent networks also provide a platform on which Third World countries can, over the long run, develop their own

[28] The World Bank defines these "low-income countries" as those with a gross domestic per capita income of less than U.S. $635.

[29] *The Least Developed Countries Report* (Geneva, Switzerland, UNCTAD, 1995). Of the 54 countries considered to be "low-income countries," 32 continue to have severe debt problems. Most of these are in Africa. Together, their debt totals four times their exports, and it is greater than their combined gross domestic products. "The Debt Trap and How To Escape It," *The Economist*, May 6, 1995, pp. 74–75.

[30] Karla Hoff, Ayishay Braverman, and Joseph Stiglitz (eds.), *The Economics of Rural Organization* (New York, NY: Oxford University Press/World Bank, 1993).

TABLE 1-4: Impact of Technology Advances

Technology Trends	Technology Capabilities and Applications	Social, Economic, and Political Impacts
Increased performance at greatly reduced cost —— e.g., microelectronics, fiber optics, voice and video compression, fast-packet switching, very high-density storage technology	Permits LDCs to leapfrog to advanced technology, maximizes advantage of existing technology Technologies also provide greater geographical coverage	National political/economic integration more efficient markets and more effective political control and administration Potential for the erosion of national boundaries due to reinforcement of global ties — e.g. PeaceNet, EcoNet, etc
Technology convergence due to digitization, wideband transmission, compression technologies, and standards developments	Cost efficiencies in service due to economies of scale and scope and greater networking versatility Greatly enhanced applications, such as real-time video transmission, videoconferencing and multimedia applications for the home, the desktop, or (less expensively) public point-of-sale terminals	Greater support for the low-cost provision of public services such as health care and education. Multimedia is especially useful in LDCs given high Illiteracy rates. Supports business applications, such as computer-aided design, desktop fax videoconferencing.
Unbundling of communication functions and services due to the emergence of competing technologies, the dispersal of intelligence throughout communication networks, the demand of large users, and deregulatory communication policies	Permits users to separately purchase communication functions and services Allows for greater flexibility in network design and architecture. More networking options and freedom to customize networks to minimize costs or to match specific needs Lower costs also due to greater competition among vendors and service providers. Interoperability, network integration, and network management likely to require greater technology expertise.	Democratic process likely to benefit from greater diversity of communication sources and network designs. Allows developing countries to manufacture low-end components and gain technology expertise. Less elaborate and expensive systems may provide more “appropriate” technology to meet developing country needs. On the other hand, problems of interoperability and increased complexity can create new reformation bottlenecks with consequences for politics and the economy. Technology experts and system integrators become new information gatekeepers.
Increased ease of use as a result of advances in storage, microelectronics, speech recognition, and search engines Applications include simple-to-use graphic user Interfaces (such as Windows), network browsers (such as Netscape) and intelligent agents	Supports greater network access and usage, promotes deployment, and reduces the level of expertise required to take advantage of information technologies	Reduces access barriers with positive benefits for both competitive markets and democratic politics

TABLE 1-4: Impact of Technology Advance

Technology Trends	Technology Capabilities and Applications	Social, Economic, and Political Impacts
Decentralized Intelligence throughout communications systems due to software-driven and software-defined communication networks.	Provides for two-way interaction and greater user control Applications include interactive television, personal digital assistants, desktop publishing, intelligent networks, and expert systems. Provide a platform for creating value-added services, such as 800 number, point of sale, credit authorization.	In most LDCs, two-way, Interactive media can support local grass-roots participation, thereby enhancing democratic processes. Provides an opportunity to develop specialized or local content to reinforce community ties Value-added services provide or substitute for a lack of an information infrastructure (banks Insurance, legal
Increased networking capabilities due in part to advances in integration and switching technologies such as routers, intelligent hubs, and asynchronous transfer mode (ATM), frame relay, together with advances in wideband transmission technologies such as SO NET, and software support applications such as CAD-CAM, EDI, groupware, as well as the development of standards and networking protocols such as TCT/IP and application programming interfaces.	Supports distributed client-server computing and cooperative work applications such as e-mail, EDI, computer-integrated manufacturing, teleworking and groupware Provides support for the development of specialized functional networks, such as financial services networks or special interest group networks such as EcoNet	Supports democratic politics by helping individuals locate information, identify like-minded people, deliberate, and voice opinions Networks help businesses and firms reduce their costs by integrating processes and information, and to gain a strategic advantage by developing exclusive networks that lock m customers and suppliers, Without access to advanced networking technologies, developing countries may become locked out
Increased mobility and portability due to distributed intelligence and advances in wireless technologies such as satellite/VSAT, cellular telephony, PCS, radio paging, digital radio, and wireless LANs, WANs, and PBXs.	Low-cost alternative to wireline technologies for use in difficult-to-reach, high cost areas. Greater ease and speed of deployment Allows for greater network flexibility and support for remote information access and processing Applications include wireless networks based on a mesh rather than hub architecture When combined with unbundled, intelligent peripherals, wireless networks support the widespread distribution of information and "intelligence" to all areas Applications include CD-ROM libraries or expert health care systems	Facilitates open markets and democratic politics by supporting access to political and economic Information and communication networks as well as to expertise and "intelligence" from and to anywhere Facilitates network configuration and shared Information systems which support the competence of local governments, and reinforces community ties

SOURCE: Office of Technology Assessment, 1995.

BOX 1-1: Markets and Information

Communication is inherent in the coordination of all economic activity. A market relies on the communication of information to identify buyers and sellers, allocate resources, and establish prices. Within firms, the availability of timely and accurate information is key to decisions about whether to enter or exit markets, how to secure financing, how to organize working relationships, and how to market and distribute goods. Where adequate information is not available, markets will fail and economic performance will suffer because of higher business costs. Likewise, firms that lack adequate market information will be at a competitive disadvantage.

SOURCE: Office of Technology Assessment, 1995.

services and service industries. By taking advantage of such possibilities, the country of Singapore, for example, has become one of the leading business service providers in the world.

Technology Advance in Support of Democracy

The prospects for democracy in developing countries are also greater because of technology advances (see box 1-2). For example, improved networking capabilities, which make it possible to develop specialized, distributed, many-to-many applications such as bulletin boards and groupware, can help individuals locate information; identify like-minded people; deliberate their ideas, organize their activities; and lobby for their points of view. Already, such networks are being used to link special interest groups across national boundaries and with considerable effect (see box 1-3).

The trend towards the unbundling of communication functions and services can also have a significant payoff for democracy. Given the greater flexibility in network design and architecture that unbundling allows, developing countries can deploy customized, lower cost systems in remote areas, thereby extending information access on a much wider basis. The diversity of communication networks is also important for democracy because it permits a greater variety of information sources. This capability is especially important in developing countries, where communications have typically been generated at the center of power and then disseminated outward. Technologies often have different geographic and spatial biases, with some being more capable than others in supporting communication both to, and within, remote areas (see chapter 3).[31]

Technology Advances to Support Political Stability

Just as technology advances hold promise to foster economic development and democracy in Third World countries, so too they can play a supportive role in helping to sustain political stability in these areas. For political regimes to be stable, they must not only prove themselves competent in carrying out the affairs of government; they must also be able to assure that basic public needs are met and that benefits are perceived to be distributed equitably.[32] In addition, if governments are to provide such services without themselves becoming overbearing, the capacity of voluntary associations and local government must simultaneously be upgraded.[33] Communi-

[31] James W. Carey, "Space, Time, and Communications: A Tribute to Harold Innis," in James W. Carey (ed.), *Communication as Culture: Essays on Media and Society* (Boston, MA: Unwin Hyman, 1989), p. 147.

[32] Juan J. Linz and Alfred Stephan (eds.), *The Breakdown of Democratic Regimes* (Baltimore, MD: Johns Hopkins Press, 1978).

[33] As described in *Human Development Report 1993*, "Changing the power equation requires the organization of a countervailing force, or even a revolution. People's organizations—be they farmers' cooperatives, residents' associations or consumer groups—offer some of the most important sources of countervailing power. And they often exercise it most effectively through the sharing of information and ideas—it is ideas, not vested interests, that rule the world for good or evil." op. cit., footnote 13, p. 29.

BOX 1-2: Communication and Democracy

Communication and information pervade political life. Without them there could be no nation; for it is through the process of communication that people first develop a sense of community and a shared set of values that legitimize political authority. By magnifying and amplifying some actions, the communication process distinguishes between what is a private act and what is a public affair. It organizes what appears to be random activities to show how individuals and groups are related to one another in pursuit of power, providing a roadmap for individuals who want to influence the course of political events. Citizens rely on the communication process to gather information, identify like-minded people, deliberate their points of view, organize their forces, and articulate their political preferences. Furthermore, because it generates a common fund of knowledge and information, the communication system facilitates productive and rational debate. Without some form of knowledge and understanding of how others are informed and what they believe, individuals could not make reasoned and sensible arguments and decisions.

SOURCE: Office of Technology Assessment, 1995.

BOX 1-3: EcoNet

EcoNet is a virtual community of over 10,000 individuals and organizations in over 90 countries who are working for environmental preservation and sustainability. Members of EcoNet have access to hundreds of private and public online electronic mail conferences through which they exchange information and collaborate on environmental initiatives of local, national or global concern. Individuals or organizations in the United States may pay to join EcoNet through its parent organization—the Institute for Global Communications (IGC) in San Francisco—which is part of the larger Association for Progressive Communications. The EcoNet Internet server provides a gateway not only to the home pages of member organizations such as the National Audubon Society and the Earth Island Institute, but also to the Internet sites of thousands of organizations and government agencies worldwide with information on environmental issues.

SOURCE: Office of Technology Assessment, 1995.

cation technologies have something to offer in all three regards.

Taking advantage of the trends toward networking and decentralized intelligence, for example, developing country leaders can, like businessmen, enhance their governing capability by using interactive expert systems and databases (see box 1-4). For even greater benefit, these systems can be networked to let government officials remotely access the global store of information.[34] Equally—if not more—important, these technologies can be used to help governments develop and network their own information resources regarding conditions in their countries. Today, many developing countries are dependent on foreign countries for information about themselves.[35]

Communication technologies can also be used to distribute public services such as distance healthcare and educational services much more

[34] Jacques Gaillard, *Scientists in the Third World* (Lexington, KY: University of Kentucky Press, 1991). Commenting on the lack of scientific journals, books, and other sources of technological information in developing countries, Gaillard notes that of the career scientists interviewed in the course of this study, 36 percent had no communication with scientists in countries where they had originally studied and done their research.

[35] Raul Zambrano, "The UNDP Sustainable Development Network," *Bulletin of the American Society for Information Science*, February/March 1995, p. 23.

BOX 1-4: The Sustainable Human Development Network Program

In many developing countries, decisionmakers do not have access to up-to-date information needed to make key policy decisions. One program designed to assist in this regard is the Sustainable Human Development Networking Program (SDNP), established by the United Nations Development Program in May 1992. Participants include 12 countries from Africa, Asia, and Latin America.

The aim of SDNP is to link users and providers of information on sustainable human development via computer networks that operate over the Internet. Designed to complement existing systems, SDNP provides support both for network deployment and training, information generation, and the norms of information sharing and exchange. The program is open to all interested parties, including national governments, nongovernmental organizations, academics, business, and the media. The SDNP program builds on local talent and expertise. In addition, each node on the system operates independently of each other, and definitions of sustainable human development are determined locally. Seed money is provided upfront, but projects are intended to become self-financing, so that funding will gradually be reduced by as much as 50 percent or more.

SOURCE: Raul Zambrano, "The UNDP Sustainable Development Network," *Bulletin of the American Society for Information Science,* February/March 1995, pp. 23–24.

cost-effectively.[36] Technology convergence, which provides the platform for nontext-based multimedia applications, is especially promising, given the high illiteracy rates in developing countries. Finally, both of these developments can be used in similar fashions to empower voluntary organizations and local governments.[37]

Further Marginalization of Those Without Access

Because advanced communication technologies can serve so many developing country needs, countries without access to them will be at a considerable loss. Missed opportunities due to lack of communication access will have much more dire consequences in the future given intense competition among nations in an increasingly networked and knowledge-based, global economy. Assuming present rates and patterns of technology diffusion, and the global forces driving them, uneven access will probably exacerbate the gap that is already widening between the newly industrializing and the least developed countries.

The development pattern of the Third World countries began to diverge significantly in the early 1980s with the onset of the debt crisis (see chapter 2). Although developing countries all faced many of the same hardships, a number of them outperformed the others by a considerable margin. Most successful in this regard were the East Asian countries—Korea, Taiwan, Singapore, and Hong Kong, which developed highly successful export-oriented growth strategies. Between 1960 and 1989, for example, these countries increased their exports from $2 billion (which constituted five percent of all developing country exports) to $246 billion (or 32 percent of all developing country exports).[38] This export growth not only served to prime the newly industrializing countries', (NICs) domestic economies; it also provided the foreign exchange

[36] See U. S. Congress, Office of Technology Assessment, *Linking for Learning: A New Course for Education* (Washington, DC: U.S. Government Printing Office, November 1989); and U. S. Congress, Office of Technology Assessment, *Healthcare on Line* (Washington, DC: U.S. Government Printing Office, September 1995).

[37] Pieter Kok, "The Role of Information Technology in Community Empowerment and Development," *In Focus,* February/March 1995, p. 25.

[38] Anne O. Krueger, op. cit., footnote 2, p. 105.

necessary for them to survive the subsequent downturn in the global economy.

A similar line of demarcation is being drawn today. Unlike most developing countries, which continue to be mired in civil conflicts, political instability, and economic decline, 12 countries have improved their economic performance during the first half of the 1990s, with significant increases in per capita output. Included are Bangladesh, Benin, Cambodia, Equatorial Guinea, Guinea-Bissau, the Lao People's Democratic Republic, Lesotho, Mozambique, Myanmar, Sao Tome and Principe, the Solomon Islands and Sudan.[39] As was the case with their predecessors a decade earlier, the success of these 12 can be attributed, in part, to their ability to maintain internal stability while reaching outward to the global economy.

If other less developed countries are to be similarly successful, they too must gain the inner capacity that will give them the flexibility to adapt to the major structural changes taking place in their external environment (see chapter 3). Most importantly given these changes, they must be prepared to compete in a knowledge-based global economy in which production takes place on a worldwide, but nonetheless decentralized and flexible, basis. The first countries to adapt to these changes will gain a significant competitive advantage, while those failing to do so will probably experience greater decline.

Communication and information technologies are not only driving these trends, they can also help developing countries adapt to them. Taking advantage of global communication networks, Third World countries will have a better opportunity to become full participants in the global economy, reaping a number of benefits as a result.[40]

Using technology to access worldwide demand, for example, Third World businesses can operate on a larger, more efficient scale, thus becoming more competitive with firms in industrialized countries. Even small businesses will be able to expand their activities.[41] For example, a small business that serves a single niche market in a developing country can increase its size by using communication technologies to identify similar niche markets in other countries. Small firms in developing countries can also use networking technologies to partner with the growing number of globally dispersed firms that outsource many activities to Third World countries. Or alternatively, small businesses can use communication networks to link their operations together, allowing them to function and compete as if they were much larger entities. This kind of networking approach was used, for example, by the Italian clothing manufacturer, Benneton, with remarkable success.[42]

Equally important, by operating globally, Third World businesses will have access to greater financial resources and opportunities for technology transfer. In the past, most large scale Third World companies were subsidiaries of foreign firms. Because the parent firms were located, and directed their operations from, abroad—close to their major suppliers and mar-

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[39] *The Least Developed Countries Report*, op. cit., footnote 29. As some OTA reviewers have pointed out, however, it is still not clear that these countries have in fact successfully reached the point of "take off."

[40] See for a general discussion that focuses on the post Uruguay Round environment, Richard Harmsen, "The Uruguay Round: A Boon for the World Economy," *Finance and Development*, March 1995, pp. 24–43.

[41] As described by R. Badrinath, "Previously, gaining entry into distant markets was out of the question for a majority of SMEs [small and medium size enterprises]. Even assuming that they could organize the finance and production aspects of their operations effectively, foreign markets raised almost insurmountable obstacles. The process of market selection, buyer identification, visits abroad with quantities of samples, preparation of business offers and counter proposals, discussion of specifications and so on required large investments of time, energy, and resources. Today, much of this can be done without leaving the workplace, thanks to the telephone, fax and other telecommunication facilities." R. Badrinath, "Helping Small and Medium-Size Firms to Enter Export Markets," *International Trade Forum*, February 1994, p. 6.

[42] Cristiano Antonelli, "New Information Technology and Industrial Organization—Experience and Trends in Italy," in *Information Technology and New Growth Opportunities* (Paris, France: OECD Development Center Studies, 1989). See also OTA, *Electronic Enterprises*, op. cit., footnote 4.

kets—there were few positive "spillovers" for developing countries. Today, this is no longer the case.[43] Local firms that partner with global companies as suppliers or value added providers have much more to gain, as India's highly successful export-oriented software industry clearly attests.[44] Working with foreign firms, Indian software contractors have been able to access the latest standards, technological platforms, productivity tools, quality requirements, and upfront financing, all of which have been critical to their success.

If developing countries deploy advanced communication technologies in tandem with developed countries, they can also compete in the expanding global services markets on a more equal basis. One of the first countries to recognize this opportunity was Singapore, which has prospered greatly as a result. By 1990, Singapore had become the 17th largest trading nation in the world, and was home to the regional headquarters of more than 600 multinational corporations (see box 1-5).[45]

National governments have not been alone in recognizing the potential for information networking to enhance global trade. Recently, for example, the United Nations sponsored the global Trade Point Program, which aims to promote trade through the establishment of a series of "trade points" or trade facilitation centers that provide companies with greater access to communication networks and trade-related information. Already, there are 59 such Trade Points in 45 countries serving as clearinghouses for trade leads, custom and tariff information, sources of financing, qualified freight forwarders and insurers, and market overviews. Trade Points offer services either physically, in a centrally located office, or on-line by connecting customers and service providers electronically. The United Nations estimates that 100 Trade Points will be in operation by 1996.[46]

As the benefits of using communication networks increase, so too do the costs of not having access to them. Opportunity costs are especially high in the case of networking technologies,

BOX 1-5: The Singapore Strategy

When, in the early 1970s, multinational corporations began to transfer their manufacturing operations from Singapore to lower cost labor countries such as Malaysia, Thailand, and Indonesia, the government of Singapore was quick to adopt a more service-oriented, export-led strategy. Recognizing the role that the communication and information infrastructure might play in capturing the benefits of global trade, government officials undertook to create a totally electronic trading environment, with the aim of transforming Singapore by the end of the century into an "intelligent island." By providing multinational corporations efficient, one-stop global networking and value-added trade services, Singapore was able to establish itself as the major trading hub in Asia.

SOURCE: Office of Technology Assessment, 1995.

[43] For example, a recent study examining the role of multinational firms in economic development found that foreign multinationals pay higher wages than domestic developing countries and provide significant technology transfer. "The Role of Multinationals in Economic Development," *Columbia Journal of World Business*, vol. 29, No. 4, winter 1994, pp. 6–11. Alternatively, others argue that, in providing such benefits, multinational firms tend to aggravate income disparities within developing countries, thereby creating problems of legitimacy for political regimes. For this perspective see Kenneth Bollen, "World System Position, Dependency and Democracy: The Cross-National Evidence," *American Sociological Review*, vol. 48, No. 4, August 1983, pp. 468–479.

[44] Nagy Hanna, Ken Guy, and Erik Arnold, *The Diffusion of Information Technology: Experience of Industrial Countries and Lessons for Developing Countries*, World Bank Discussion Papers, No. 281 (Washington, DC: The World Bank, 1995), p. 120.

[45] Robin Mansell and Michael Jenkins, "Networks, Industrial Restructuring, and Policy: The Singapore Example," in *Technovation*, vol. 12, No. 6, September 1992.

[46] UN's Conference for Trade and Development World Wide Web Server http://gatekeeper.unicc.org/unptdc//, and Trade Point U.S.A. Columbus Ohio, http://www.natp.iftea.com/

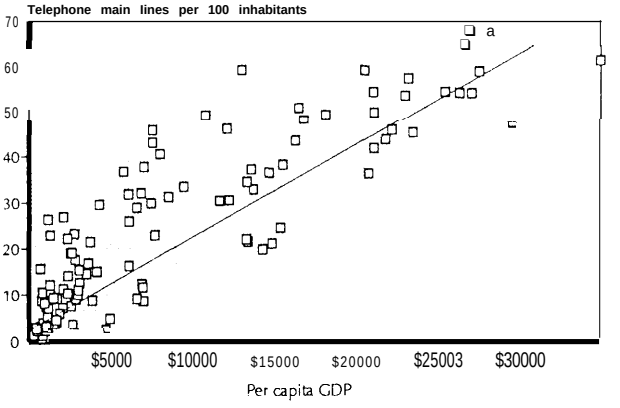
which give rise to "first mover advantages." Thus, as Singapore clearly recognized, the first country to establish a technology-based global trade network can gain a hefty competitive advantage, not simply because the capital costs entailed are so high, but also because electronic networks require considerable "learning by doing." Moreover, once business users have expended the energy, expertise, and financial resources required to use a particular network, and have become linked up with other network users, they tend to get "locked in."[47]

Given present rates and patterns of technology diffusion, and the forces driving them, the poorest developing countries, as well as the poorest regions within developing countries, will probably be left behind in a network-based global economy (see chapter 4). There are today tremendous disparities in the diffusion of information and communication technologies throughout the world. Because technology disparities mirror those in income distribution, they will probably reinforce the growing economic gap among nations (see figure 1-2).

Even more alarming, this gap between the telecommunications "haves" and "have nots" shows little signs of receding. In the 10 years since the Maitland Commission issued its report, *The Missing Link*—which first noted the telecommunications gap, and called on developed countries to take steps to reduce it—very little progress has been made.[48] There are today 50 countries, which together comprise more than half of the world's population, that still have less than one main telephone line for every 100 persons. Given their present rates of technology deployment, many of these countries will fail to reach this level of teledensity by the year 2000 (see figure 1-3 and figure 1-4).

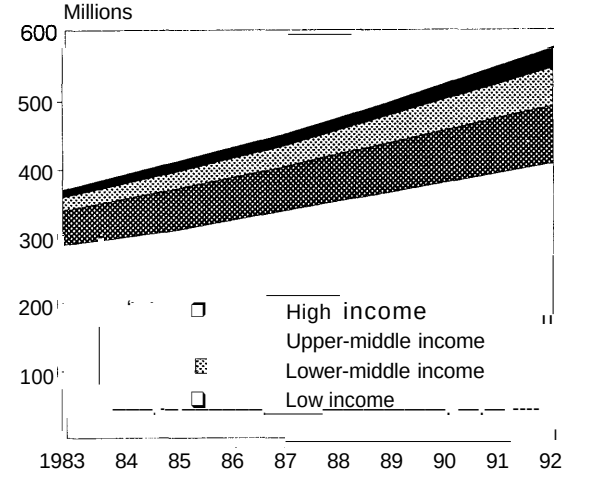
Assuring the relatively even deployment of communication technologies presents problems of staggering proportions. Even as some countries race to keep up, others are deploying yet more advanced technologies. Thus, for example, it is estimated that it will cost $120 billion

FIGURE 1-2: National Wealth and Telephone Density



SOURCE: ITU, UN, World Bank, OECD

FIGURE 1-3: Main Telephone Lines

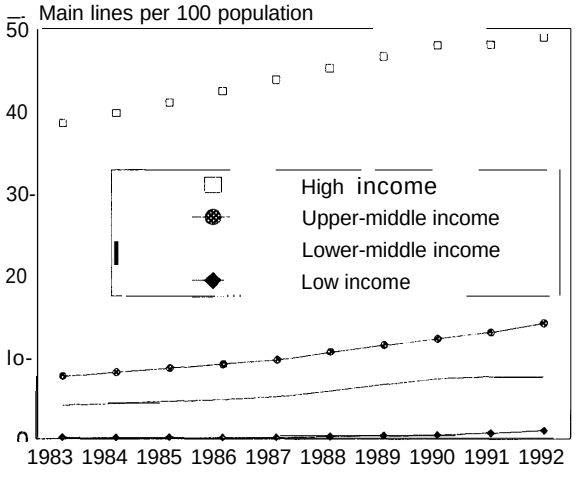


SOURCE: ITU/BDT Telecommunications Indicator Database

47 Joseph Farrell and Garth Saloner, "Horses, Penguins and Lemmings," in H. Landis Gabel (cd.), *Product Standardization and Competitive Strategy* (The Netherlands: North Holland, 1987).

48 World Telecommunications Development Report (Geneva, Switzerland: International Telecommunications Union, 1994), p. 73.

FIGURE 1-4: Telephone Density



SOURCE: ITU/BDT Telecommunications Indicator Database.

between now and early 2005 just to upgrade the Central and Eastern European communication networks. During the same period, the European Community plans to spend approximately $24.8 billion per year to develop a broadband telecommunications infrastructure.[49]

A lack of education and technical expertise will also make it difficult for developing countries to take advantage of many technologies (see box 1-6). For example, although the Internet provides developing countries with an inexpensive way of gaining access to networking services such as e-mail and remote file transfer, its usage requires a level of technical understanding and comfort that is unlikely to be found in poorer areas. Not surprisingly, therefore, Internet growth has been strongest in countries such as India and Malaysia, where a computer culture already exists .50

The Trade Dividend

In today's increasingly liberalized, global telecommunications marketplace, many developing countries' communication needs can be met by the private sector. Already, many firms are eagerly competing to invest in and/or partner with developing countries to serve their rapidly growing communication markets. U.S. firms are especially well positioned in this regard. They are foremost in the development and deployment of communication and information technologies and principal players in the information and communication technology and services trade arenas. Some foreign support and incentives will be necessary, however, if all developing country needs are to be met. By providing such telecommunication-related foreign assistance on a targeted basis to those countries and rural areas least likely to be served, the United States can not only foster U.S. foreign policy goals; at the same time, it can also promote deregulation and generate greater telecommunications demand, thereby creating new trade and investment opportunities for the United States.

Information and communication technologies, operating in a newly deregulated and increasingly competitive economic climate, are rapidly reconfiguring national communication systems and linking them together into networks spanning the globe. These changes have greatly reduced telecommunication costs, and generated a broad range of new products and services that can be produced and traded on a global scale. As a result, telecommunications is one of the fastest growing sectors in the international market, with total revenues of $535 billion for 1992, and annual growth rates averaging between 8 and 9 percent.[51]

The increased flow and demand for information and services across national borders is wear-

49 Donne Pinsky, "Euro. Infrastructure Group Proposed" *Communications Week International,* May 11, 1992, p. 6.

50 As described by Goodman, et al., "Networks are often perceived by many in LDC's (the "south") as intended to 'talk to people in the north. ' There may not be much perception of the need for local-to-local communications. Furthermore, there may be little in the way of a culture for sharing information locally, nor of doing business in an impersonal way." S. E. Goodman, L. 1. Press, S. R. Ruth, and A.M. Rutkowski, "The Global Diffusion of the Internet: Patterns and Problems," *Communications of the ACM, vol. 37, No. 8,* August 1994, p. 30.

51 ITU Press Release of report released in Buenos Aires at the World Telecommunication Development Conference, Mar. 21, 1994.

BOX 1-6: Education and Training In Developing Countries

The problem of education in developing countries is not simply one of providing schooling; even more significant is the difficulty of matching education to workplace needs. Thus, in many developing countries, one finds that the number of unemployed secondary school graduates is greater than those with lesser education. The situation is even greater for those with university and graduate degrees. In Bangladesh, for example, almost 40 percent of those with master's degrees are either unemployed or underemployed. Similarly, the rate of unemployment for university graduates in Thailand ranged between 20 and 30 percent from 1973 to 1983. This gap between education and jobs could be much greater in the future, given cutbacks in government recruitment.

Source: *Human Development Report 1993* (New York: NY: U.N. Development Program, 1993), p. 38.

ing away the distinctions between domestic and international communication systems and markets. Whereas national telecommunication monopolies once controlled the manufacturing, production, and provisioning of most communication products and services, today international conglomerates are being formed to meet the business demand for transparent and seamless world-wide services. Already 45 percent of the world's telephone access lines are managed by private companies.[52]

This shift towards a global communications environment affords a number of opportunities for U.S. telecommunication companies, which are in the forefront in striking transnational mergers, alliances, and other cooperative arrangements (see chapter 4). U.S. exports of telecommunications equipment including central office switches, transceivers for radiotelephony, fiber optics, satellites and customer premises equipment grew at an average annual rate of 18 percent between 1989 and 1993, when the United States achieved a trade surplus in this area for the first time in 10 years with exports totaling $3.2 billion.[53]

The prospects for continued growth in U.S. trade and foreign investment are high, given technology convergence and the development of a wide array of new products and services; the growth in worldwide demand; the provision for telecommunication services within the World Trade Organization (WTO) and the North Atlantic Free Trade Association (NAFTA); and the liberalization and privatization of many telecommunication regimes. New opportunities will also abound as countries throughout the world—recognizing the strategic nature of telecommunications investments—turn to new technologies to modernize and upgrade their networks. This international growth potential is especially important for countries such as the United States, where the domestic market for many telecommunication-related products and services is rapidly becoming saturated.[54]

Trade and investment opportunities are especially promising in the developing world where penetration levels are low and projected demand is high, given increased prosperity and a rising middle class.[55] China, for instance, is replete with possibilities for U.S. equipment manufac-

[52] "What Are the Implications for Your Business of the Global Telecoms Revolution," *Management Accounting*, June 1992, p. 40.

[53] "Industry and Trade Summary: Telecommunications Equipment," U.S. International Trade Commission, Publication 2820, October 1994, Washington, DC, p. 31. The principal markets for U.S. telecom exports are Canada, Mexico, Japan, China, and the United Kingdom.

[54] U.S. Congress, Office of Technology Assessment, *U.S. Telecommunications Services in European Markets*, OTA-TCT-548 (Washington DC: U.S. Government Printing Office, August 1993).

[55] See Rahul Jacob, "The Big Rise: Middle Classes Explode Around the Globe, Bringing New Markets and New Prosperity," *Fortune*, May 30, 1994, vol. 129, No. 11, pp. 74–78, 82, 90; and Vivian Brownstein, "The U.S. Is Set To Be the Winner From Worldwide Expansion," *Fortune*, Nov. 28, 1994, vol. 130, No. 11, pp. 22–23.

turers, given a telephone penetration rate of 0.98 and a population totaling more than 1 billion. The prospects for U.S. companies in Latin America are equally great.[56] In Mexico alone, the market for wireline equipment now exceeds $2 billion annually. As developing countries press to modernize their networks, the market for advanced technologies will also experience considerable growth. In 1992, for example, more than $4.6 billion was spent on digital switching in the developing countries. Estimates are that this market will exceed $7 billion by the year 2000.[57]

Whether or not U.S. companies will be able to access these growing market opportunities will depend, to a considerable degree, on developments in the international telecommunication regulatory environment. Despite a growing trend towards liberalization and privatization of telecommunication regimes, national communication systems continue to differ considerably, depending on the extent to which they are government owned or operated, monopoly-based or liberalized, and/or regulated or not. At one end of the scale are countries such as the United States, New Zealand, Singapore, Malaysia, and Mexico, which are striving to minimize government involvement. At the other end are countries such as China, Brazil, and Uruguay, where the legacy of the traditional PTT is very strong (see box 1-7).

Aware of the growing importance of communication for economic growth, many developing countries hope that the privatization and liberalization of their telecommunication regimes will help them gain access to the foreign capital and expertise needed to develop their national communication infrastructures. Describing the motivations and tensions inherent in these kinds of decisions, one observer has noted:

> Perhaps for the first time communications are being recognized as the strategic underpinning of civilization, as important perhaps as the provision of clean water. The implicit fear for many countries must be that an adequate infrastructure will forever keep a national economy out of the world economic structure that is shaping up for the 21st century, in addition to the fear that government relinquishes an important tool. It is into this cauldron that telecom policy is being pushed.[58]

Seeking out new strategies, Singapore Telecom, for example, recently established a joint public-private telecom venture, which many view as a first step toward total privatization.[59] Indonesia already has such a corporate arrangement. In Malaysia, the PTT is privatized, with its stock now floated in the marketplace.[60] In Latin America, Mexico serves as a model for this kind of industry restructuring, having privatized its state PTT, TELMEX, with record speed. Similar infrastructure modernization strategies are being pursued in other parts of the world. India, for example, is developing a plan to open up its telecommunication sector to private investment, as are countries in Eastern Europe. Even China, which has long opposed foreign investment, is now considering foreign bids to support its goal of providing 40 million new lines by the year 2000.[61]

Foreign direct investment (FDI) in the telecommunications sector has been particularly popular, generally taking the form of either joint ventures or corporatization and sale of a major or controlling equity stake in the telecommunications provider. These kinds of arrangements offer

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[56] Bruce E. Beebe and Peter Kennedy Jr., "Latin America Heats Up," *Journal of Business Strategy*, vol. 15, No. 5, pp. 52–55.

[57] Robin Bromby, "Digital Switching Markets in Developing Countries Report," *Telecommunications (International Edition)*, vol. 27, October 1993, pp. 16–18.

[58] Stephen McClelland, "The International Dimensions: The PTTs," *Telecommunications*, June 1992, p. 31.

[59] "Singapore Starts Telecom Selloff," *Telecom Highlights International*, vol. 15, No. 34, Aug. 25, 1993, p. 5.

[60] "World Bank Paper Urges Telecom Liberalization," *Telecom Highlights International*, vol. 16, No. 8, Sept. 8, 1993.

[61] "World Bank Sets Telecom Aid Rules," *Telecom Highlights International*, vol. 16, No. 11, Mar. 16, 1994, p. 4.

BOX 1-7: The Post, Telephone, and Telegraph (PTT) Model

In many countries, the government has historically assumed direct ownership and control over the country's telecommunication networks. The typical organizational pattern to emerge was that of the PTTs—the government administrations of post, telephone, and telegraph. This model evolved in Europe over a century and a half, during which time national governments, coveting the lucrative postal revenues, finally, and after intense struggles, assumed control over their respective postal systems. Eventually, however, it was the telephone that provided revenues to subsidize the PTTs' activities.

As developing countries gained their independence, the PTT model was retained. This model appealed to many Third World leaders, not only because it gave them control over the national communication infrastructure, but also because it generated a major source of government revenue. In fact, in many developing countries, the PTT's role in generating revenues has always had top priority. Instead of reinvesting substantial amounts of the telecommunication administration's operational surplus, funds have been siphoned off by governments for other purposes. In Syria, for example, the state imposed an 80 percent tax on the state-owned telephone company from 1985 to 1991. The demand for telecommunications has also been dampened by artificially high prices, which are based on tariff structures that are designed to generate general revenue. These policies have resulted in very poor service and a tremendous backlog in demand. Thus, for example, in more than 61 countries, call completion rates are lower than 40 percent.

SOURCE: Office of Technology Assessment, 1995.

a number of advantages to developing and developed countries alike.[62]

Developing countries can benefit in a number of ways from the foreign purchase of either all, or a portion of, their telecommunications operations. Often, investors are obligated to expend a considerable amount of money to extend and upgrade service in exchange for control over the enterprise and certain guaranteed exclusive rights. Such arrangements allow developing countries to reduce their foreign debt while upgrading their national infrastructure.[63] At the same time, they can gain greater access to advanced technology, markets in developed countries, as well as hard currency. Foreign direct investments are also more secure than other types of foreign investment, being less volatile and subject to interest rate fluctuations. FDI agreements can, moreover, be customized to meet a developing country's specific needs and concerns. Flexibility and appropriate timing are critical for success.[64]

For investors and businesses in developed countries, there are similar gains to be made. Above all, these partnering arrangements allow foreign vendors to obtain a foothold—and often a major competitive advantage—in some of the most profitable and rapidly growing telecommunication markets. Given the tremendous backlog of demand in developing countries, these investments can be made with minimal risk. By accelerating technology deployment in the Third World, FDI in telecommunications also paves the way for related service industries—such as

[62] Robert R. Bruce, Jeffery P. Cunard, and Lothar A. Kneifel, "Exploring New Ways to Attract Capital for Privatization," in Bjorn Wellenius and Peter A. Stern (eds.), *Implementing Reforms in the Telecommunications Sector: Lessons From Experience* (Washington, DC: The World Bank, 1994), chap. 28, pp. 463–499.

[63] Aileen A. Pisciotta, "Telecommunications Reforms: Options, Models, and Global Challenges," *IEEE Communications Magazine*, November 1994, p. 29. See also T. H. Chowdary, "Telecommunications Restructuring in Developing Countries," *Telecommunications Policy*, September/October 1992, pp. 591–611.

[64] Peter L. Smith and Gregory C. Staple, "Telecommunications Sector Reform," *IEEE Communications Magazine*, Nov. 1994, p. 51; and Clive Cook, "Third World Finance: New Ways To Grow," *The Economist*, Sept. 25, 1993, pp. SS5–SS7.

banking, insurance, and tourism—as well as for multinational corporations, which depend on networking technologies for their survival and growth. In the long run, investments linked to telecommunications privatization may also enhance the overall economic climate in developing countries in favor of open markets and greater economic reforms (see chapter 4).

For U.S. companies to achieve full market access in foreign countries, privatization of telecommunication systems will not be enough. Developing countries will also need to liberalize their regulatory systems to allow for competition, establishing pricing structures that mirror true costs and rules of interconnection that are consistent, transparent, and comparable for all parties. It is these rules that establish how alternate providers can access the public network, and determine the prices charged for such access. Interconnection rules are required not only for providers from different countries but also for different kinds of providers within each country. For example, there need to be common rules governing the relationship between public and private networks, between value-added data services and public networks, and between providers of public voice services whether they are fixed or mobile (see box 1-8).[65]

Although the global market is driving the deployment of advanced communication technologies and channeling investments in telecommunications to developing countries, its impact is uneven. As has historically been the case for all networked technologies, diffusion is following a sequential pattern, starting in centers of economic activities and areas with major populations and working outward, from major cities, to smaller towns, and eventually to rural villages and remote areas.

In the past, most governments were able to speed up, and smooth out, this diffusion pattern, using cross subsidies and price averaging. Subsidies, however, are no longer a tenable option in a global economy in which developing countries must compete to attract worldwide business. Already, those countries that are slow to dismantle their traditional regulatory regimes run the risk of being bypassed.[66]

In this interdependent global environment, the United States has an interest—both from a trade as well as from a foreign policy perspective—to help assure that these underserved areas are not left far behind. Networks are not only subject to economies of scale and scope; they also exhibit positive externalities. The value of networks and the resulting demand for networking technologies will likely increase—at least in the early stages of deployment—when networks, users, and applications are extended and linked together.[67] Thus, support for networking in underserved areas will not compete with, but instead will complement and add value to, the information networks that are presently being deployed in high-density areas. As an added benefit, given more even deployment, Third World governments will probably be under less pressure to use subsidies from local or international calls to promote access, and hence be more willing to promote regulatory reforms and open their markets to U.S. equipment and service providers.

CRITERIA FOR MAKING POLICY CHOICES

Telecommunication-based aid programs are likely to have a high payoff. Because communication and information networking technologies have a dual nature, which allows them to serve both as an infrastructure and a commodity, they are uniquely suited to support flexible and holistic development programs within the context of competitive, open markets. By targeting poor and underserved areas, telecommunication-based aid programs can enhance U.S. trade opportuni-

[65] Graham Finnie, "Interconnect: New Operators Plug In," *CommunicationsWeek International*, Mar. 16, 1992, p. 18.

[66] Johannes M. Bauer, "The Emergence of Global Networks in Telecommunications: Transcending National Regulations and Market Constraints," *Journal of Economic Issues*, vol. 28, No. 2, June 1994, pp. 391–402.

[67] Cristiano Antonnelli, "The Economic Theory of Information Networks," in Cristiano Antonnelli (ed.), *The Economics of Information Networks* (The Netherlands: North Holland, 1992), chap. 1.

BOX 1-8: Pricing Disparities and International Accounts

The impact that pricing disparities can have on trade is particularly apparent when trying to reconcile international accounts. Because international calls entail the use of facilities in two countries, revenues and costs need to be shared between them. To settle accounts, the provider in the country in which a call originates pays the facility owner in the country where the call is completed a sum based on a bilaterally negotiated "accounting rate" (the agreed upon cost of the call) and "settlement rate" (the agreed upon percentage split of the revenues, which customarily is 50 percent).

If there is a large gap in the prices charged in each country, problems will likely arise, as is happening in the United States today. When possible, users initiate calls in the United States because the rates, which are subject to competitive pressures, are lowest there. This is not necessarily beneficial, however. Because American providers initiate more calls than they receive, they must pay out an excess of funds, which take the form of a trade deficit. Moreover, because international accounting rates are generally inconsistent with true costs, it may be difficult for American service providers to cover their total costs. In fact, depending on the accounting and settlement rates, they may actually subsidize a foreign vendor's service.

Within the international telecommunications community, there is increasing pressure to revise the system of international accounting rates. The pressure is coming from a number of directions. Settlement payments provide an important and growing form of hard currency to a number of developing countries, which if transferred to the operator, could be used to cross subsidize network development. Developing countries would, therefore, like to see the 50-50 basis for sharing revenues shifted in their favor perhaps to 55-45. They contend that the cost of providing infrastructure and, therefore, the cost of terminating a call is much higher in some developing countries than in the advanced industrialized nations. On the other hand, most developed countries strongly believe that accounting rates should be reduced in line with technical improvements so as to more closely approximate costs. Efforts within the International Telecommunications Union (ITU) Study Group III to define the cost of providing international telecommunications services, however, have hit methodological and political snags. As a result, some countries would prefer to replace the whole system of accounting rates with one that provides genuine incentives for price cutting and offers more flexibility to establish innovative international services.

SOURCE: Office of Technology Assessment, 1995.

ties in developing countries, promote competition and telecommunications regulatory reform, while at the same time providing for the communities and people that are most in need.

As experience suggests, designing U.S. foreign assistance programs to meet the multiple goals of promoting democracy, economic development, political stability, and U.S. trade opportunities is no easy task. How communication technologies will affect Third World countries will depend on a broad range of technical, economic, social, and political factors. To lay the groundwork for developing an effective telecommunications-related aid strategy, OTA has identified a number of criteria that such a strategy must meet to enhance its chances of success. These criteria comprise an interdependent and total package. To the extent that policy measures fail to address all these criteria, the chances for success, and the likelihood that technology will be deployed to the benefit of the United States and the developing world, will be diminished.

A Technology Strategy That Supports Development Goals

Many people look to information and communication technologies to help developing countries overcome their problems and adapt to their rapidly changing environment. Experience to date,

however, demonstrates that technology alone will not be enough. In cases where technology has made a critical difference, it has been employed in conjunction with successful social, economic, and organizational change. Similarly, most obstacles to success have had to do with people and institutionalized behavior rather than with technology.[68] To develop appropriate technology-based development strategies, care must be taken to reassure that technology deployment patterns and network architectures reinforce, and do not drive, development policies and goals. For example, if communication technologies are to have a democratizing effect, they need to be widely available, easily accessible, and capable of supporting two-way interactions. On the other hand, communication technologies that are intended to reinforce a sense of community, or to support activities internal to a particular business or firm, may need to be more restrictive both with respect to content as well as access.

A Multidimensional, Integrated Notion of Economic Development

Experience suggests that if foreign aid policies are to serve the multiple goals of promoting sustainable economic development, democracy, and political stability, aid policies and programs must themselves be conceived of in a multidimensional, integrated fashion that accounts for social, economic, and political change. Because communication and information technologies are common to all these activities, they can help support a holistic development approach. As an added benefit, if communication technologies are used to serve mutual development goals, their cost will be lower because of the associated economies of scale and scope.

Minimum Cost and the Effective Use of Existing Resources

Given current national budget constraints and questions about the benefits to be derived from foreign assistance, any telecommunications related aid project will need to be financed at minimum cost. Ideally, such programs should leverage existing resources—both public as well as private—be incentive based, and self-sustaining over the long run. Moreover, given recent disagreements within the aid community about where limited aid monies might best be spent (i.e., structural reforms, environmental sustainability, poverty alleviation), a convincing case must be made to show that investments in telecommunications are not only cost effective; they can also support all these alternative spending targets.

Technology Neutrality

Advances in communication and information technologies provide developing countries the opportunity not only to "leapfrog" to high-performance technologies. They also offer much greater variety and flexibility of use. If developing countries are to maximize these advantages to design and deploy networks that are well matched to their unique situations, telecommunications-related aid policies must be neutral with respect to technology choices. Moreover, to the extent that developing countries are free to make use of a wide variety of technologies, competition and a liberalized regulatory environment will probably be advanced. The prospects for democratic participation will also be greater, given a variety of communication channels and outlets. A policy of technology neutrality is also in keeping with U.S. goals of promoting free trade and liberalization of telecommunication regimes. Equally important, it is unlikely to favor some U.S. stakeholders over others.

Flexibility to Experiment, and to Deal With the Variety of Situations and Settings Found in Developing Countries

Approaches to foreign aid have fluctuated rather significantly over the past 50 years, depending on the political climate and prevailing school of economic development thought. Given the diver-

[68] See *Electronic Enterprises*, op. cit., footnote 4.

sity of outcomes in developing countries, policymakers have, more recently, come to appreciate that no single policy approach is equally applicable under all circumstances. Our knowledge of the development process continues to be imperfect, and conditions in developing countries vary increasingly, both within and among countries. Thus, development policies must be flexible enough both to experiment with different types of approaches and to address the unique needs and strengths of each community. Communication systems will go unused, if they fail to serve developing countries' needs as they themselves perceive them.

Policies That Build On and Take Advantage of Local Competence

All too often, infrastructure projects in developing countries have deteriorated over the long run for lack of maintenance and operational funding. If telecommunication related aid projects are to be self sustaining and to promote effective use of technology, they must incorporate both a technology-transfer and an "entrepreneurial" component. Moreover, if such systems are to be truly useful, they must take advantage of, and build on, "local knowledge."

Although technology advance and network unbundling permits much greater flexibility in network design, it can, at the same time, increase the knowledge requirements and transaction costs of putting systems together. Development policies must therefore provide technical assistance to familiarize users with communication technologies and assist them in planning and devising appropriate deployment strategies. Business training and support will also be required; many economic-oriented development projects have failed for lack of sound business plans and practices and incentives and market signals that correspond to real costs.[69] To be successfully integrated into local practices, such support will need to be provided as a complement to, rather than substitute for, existing local knowledge.

Reconciliation of Trade and Economic Development Goals

In the past, foreign aid policies and U.S. trade policies have often come into conflict, thereby undermining both sets of goals (see box 1-9). In a highly competitive—but increasingly interdependent—global economy, greater efforts must be made to reconcile trade and aid goals, and to develop policies that have win-win outcomes for all.

In the specific case of telecommunications, policies should not only be consistent with free trade principles; they should also be designed to encourage the liberalization of telecommunication regimes. To this end, they should promote rather than substitute for private sector activities. Meeting these criteria should not be excessively difficult. By all accounts, the demand for telecommunication services in developing countries far exceeds the supply. The inadequate response to this demand results from regulatory barriers and the failure of the market—especially in rural areas—to effectively aggregate potential demand.

FOREIGN AID STRATEGIES TO MEET THESE CRITERIA

Targeting Rural Areas for Integrated Development Programs

Bounded by their geography, history, and culture, rural communities in the Third World constitute the focal point of events and social forces that interact to determine the fates of their inhabitants. In such close-knit environments, problems in one area of life spill over and feed on those in others. The result is a vicious circle that spirals downwards.

To reverse this pattern requires a concerted and integrated effort that addresses all these

[69] Dwight H. Perkins and Michael Roemer (eds.), *Reforming Economic Systems in Developing Countries* (Cambridge, MA: Harvard Institution for International Development, 1991); and Karla Hoff et. al., *The Economics of Rural Organization*, op. cit., footnote 30.

BOX 1-9: United States Aid and Trade Policy

As a long-term advocate of freer trade, the United States has consistently sought to establish a formal mechanism within the Organization for Economic Cooperation and Development (OECD) that would restrict the practice of tying aid donations to the purchase of donor products and services. In 1987, OECD nations agreed to provide at least 35 percent of all tied aid in the form of an outright grant. Many countries often found ways to circumvent this decision, however. In August 1992, OECD members reached a more restrictive agreement known as the Helsinki Accord. According to the Helsinki package, tied aid is limited to those countries and projects that are unlikely to qualify for commercial financing. Moreover, 80 percent of a project's costs must be covered by concessional aid, unless the OECD agrees otherwise. OECD members meet at monthly intervals to review tied aid project proposals. Tied aid credits have decreased since 1992 from $15.4 billion to $6.95 billion in 1993. Two-thirds of all untied aid is in key sectors such as telecommunications, transportation, and electric power, much of which is concentrated in Asian markets.

To further counter tied aid, the United States established a Tied Aid Capital Projects Fund within the Ex-Im Bank. The Em-Im Bank uses this fund of $150 million to counter potential tied aid offers made by U.S. competitors.

SOURCE: "Tightening Up on Tied Aid," *The China Business Review*, May-June 1993, pp. 36–40.

problems at once. Only by adopting a multifaceted approach will the solutions be mutually reinforcing as well (see box 1-10).[70] Improvement will also be more likely to the extent that development programs are community based. Insofar as they are the source of many developing countries' problems, rural communities are similarly the place where solutions can most readily be found.[71]

The need for an integrated, community-based approach to rural development problems has been reiterated by many international development experts and emphasized in the 1992 Rio Declaration on Environment and Development, which was adopted by the United Nations. Encompassing all of the activities taking place in rural environments, this approach calls for the simultaneous development of all areas including agriculture, education, communication, and health care, among others (see chapter 2).

This emphasis on rural areas has been reinforced, of late, by the growing realization that a healthy agricultural sector is critical for successful development. Having seriously underestimated agriculture's role, leaders in developing countries (as well as many development economists) have typically fostered policies that discriminate against agriculture and rural areas and promote urban industrialization. Such policies have greatly depressed investment in agriculture and reduced farmers' purchasing power significantly. In those countries exhibiting an urban bias, for example, the income transferred out of agriculture totaled—on average—46 percent of GNP for the years 1960 to 1984. In a recent study of 18 developing countries, the World Bank found, for example, that industrial protection and exchange rate overvaluation depressed agriculture's domestic terms of trade by about 22 percent.[72] Having recently come to recognize that agricultural production generates significant

[70] Partha S. Dasgupta, "Population, Poverty and the Local Environment," *Scientific American*, vol. 272, No. 2., February 1995, p. 45.
[71] "People and Governance," *Human Development Report 1993*, op. cit, chap. 2, footnote 13.
[72] Maurice Shiff and Albert Valdesm, "The Plundering of Agriculture in Developing Countries," *Finance and Development*, March 1995, pp. 44–47.

BOX 1-10: Controlling Population Growth in Developing Countries

To appreciate the need for an integrated development approach, one has but to consider the intricate linkages among rural problems. Population control is a case in point. Most population studies now show that in Third World communities, pregnancy decisions both are determined by, and have an impact on, a number of other interrelated social, economic, and environmental factors.

The correlation between fertility rates and education is particularly strong, for example.[1] According to the World Bank, women in developing countries who have no secondary education generally bear up to seven children in their lifetimes. In contrast, those who have attended secondary school average only three births.

Levels of education as they affect birth rates are related, in turn, to the health of both women and children. In developing countries, pregnancy is, for example, the primary cause of death for women of childbearing age. In fact, in some parts of sub-Saharan Africa, it is not unusual to find one maternal death per 50 live births.[2] Of equal note, when mothers are educated and have fewer children, they provide better care for their children, whose health and prospects of survival are greatly enhanced as a result. In addition, girls born in such families are more likely to be educated and thus less likely to marry early, have multiple pregnancies, and thus repeat the cycle.[3]

Education by itself is not enough, however. To discourage multiple births, women must also use their education to increase their families' incomes, raising them above subsistence levels. When rural families are totally dependent on the land, women are prized primarily for the abilities to reproduce. In subsistence households, children are needed to carry out simple, but nonetheless essential, chores, such as fetching water and fuel, cultivating crops, caring for livestock, cooking food, and producing simple marketable products. In these circumstances, having a large family is perceived not as a social or even individual cost but rather as an economic benefit.[4]

[1] "Battle of the Bulge," *The Economist*, vol. 332, No. 7879, Sept. 3, 1994, p. 23.
[2] Partha S. Dasgupta, "Population, Poverty and the Local Environment," *Scientific American*, vol. 272, No. 2., February 1995, p. 42.
[3] "Battle of the Bulge," op.cit., footnote 1.
[4] Dasgupta, op.cit., footnote 2.

SOURCE: Office of Technology Assessment, 1995.

rural household demand, which in turn stimulates industrialization, many people now consider agriculture-based rural communities to be prime targets for economic development efforts.[73]

Rural communities are also gaining greater priority among development experts because of their potential to reinforce democracy at the local level. Community-based actions can help reinforce a spirit of cooperation and the development of the type of civil society upon which democracy ultimately depends. At the same time, the mobilization of a community and/or community-based organizations can help to build local competence, thus providing a powerful counterweight to authoritarian governments and other vested interests that oppose social and economic change in developing countries (see box 1-11). As described in the *Human Development Report 1993*:

[73] Yves Bourdet, "Rural Reforms and Agricultural Productivity in Laos," *Journal of Developing Areas*, vol. 29, No. 2, January 1995, pp. 161–182; and Earl P. Scott, "Home-Based Industries: An Alternative Strategy for Household Security in Rural Zimbabwe," *Journal of Development Areas*, vol. 29, No. 2, January 1995, pp. 183–212.

BOX 1-11: The Internews Network

Local broadcasters in the Soviet Union have played a critical role in providing an independent political perspective despite strong pressure from the Kremlin to support government policies such as the war in Chechnya. To support such independent broadcast efforts, Internews Network—a voluntary organization supported by U.S. Agency for International Development and the private financier, George Soros—is reaching out to independent television stations in Russia's regions, providing seminars in journalism, business planning, advertising and technical issues. Equally important, Internews Network has established a center in Moscow where these independent stations can get together to share news and other experiences. Most people agree that these stations provide the most independent and balanced news coverage in the Soviet Union.[1]

[1] Fred Hiatt and Daniel Southerland, "Grass-Roots Aid Works Best in Russia," *Washington Post*, Feb. 12, 1995, p. A1
SOURCE: Office of Technology Assessment, 1995.

> Decentralizing governance—from capital cities to regions, towns and villages—can be one of the best means of promoting participation and efficiency. Local officials and politicians can be much more open to public scrutiny than national governments—and more accountable to the communities and individuals they are supposed to serve. And public projects—be they dams, roads, schools, or health programmes—all become more relevant and effective if the communities have a real say in their planning and implementation.[74]

Targeting rural areas for integrated development programs also ranks high based on the criteria for telecommunications-related aid laid out in this report. By focusing on rural areas, aid policies can be designed to be both comprehensive and cost-contained. It is in rural communities, for example, that small scale pilot projects can be undertaken, and that aid policies can be most easily adapted to, and brought into line with, actual social, economic, and political conditions. By focusing at the community level, aid programs can also be customized to tap into local entrepreneurship and growth potential, which is increasingly to be found in Third World rural areas. Many rural problems are, moreover, amenable to telecommunications-related interventions, so they can be dealt with jointly on a local, geographic basis, allowing for significant economies of scale and scope.[75] In fact, research shows benefits from telecommunication investments are greater when accompanied by investments in social services and other types of physical infrastructure. Rural areas are, moreover, unlikely to be served by the global market, so aid to support telecommunication will support rather than undermine telecommunications related trade.[76]

Promoting Local, Bottom-Up Deployment Strategies

The demand for communication services in Third World rural communities is, according to most assessments, far greater than available supply. The market's failure to adequately meet this demand is due to at least four basic factors: 1) high fixed costs entailed in deployment; 2) national regulatory policies that discourage telecommunications investment and maintain artificially high prices; 3) problems entailed in aggregating demand among geographically dis-

[74] *Human Development Report 1993*, op.cit., footnote 13, p. 66. See also Michael Keren and Rur Ofer (eds.), *Trials of Transition: Economic Reform in the Former Communist Bloc* (Boulder, CO: Westview Press, 1992); and A. S. Bhalla, *Uneven Development in the Third World: A Study of China and India* (New York, NY: St. Martin's Press, 1992).
[75] The International Space University, *Global Access Tele-Health and Education System*, Final Report (Barcelona, Spain: The International Space University, summer 1994).
[76] Ruby Roy Dholakia and Bari Harlam, "Telecommunications and Economic Development: Econometric Analysis of the U.S. Experience," *Telecommunications Policy*, vol. 18, No. 6, August 1994, pp. 470–477.

persed users; and 4) the excessive information costs and institutional imperfections found in rural markets (see chapter 4). One way of promoting network deployment under such circumstances would be to lend support and provide incentives for local, bottom-up deployment initiatives. Efforts focusing at the local level can yield a number of benefits, far above and beyond the actual deployment of technology itself.

Bottom-up approaches to technology deployment are not without considerable precedent. In the United States, for example, a rash of independent telephone companies, community cooperatives, and mutual societies sprang up from the midwest to California to provide service once the Bell patents expired in 1894. Using local capital and labor, and assembling much of their equipment themselves—purchased in some cases through mail order catalogs such as Sears Roebuck and Montgomery Ward—rural communities in the United States were able to have telephone service long before it would otherwise have been made available to them (see box 1-12).[77]

The United States experience is not unique. Similar efforts took place in a number of European countries, including Norway, Sweden, Finland and the Netherlands. As in the United States, these efforts served to speed the deployment of telecommunication services to rural and remote areas. Organizational approaches varied depending on local circumstances and political culture. In Finland, for example, telephone service was introduced by private individuals in 1877, before Finland had become a nation state. Absent government intervention, most telephone entities were organized as cooperatives, with subscribers exercising democratic control over local telephone operations, services, and tariffs.[78]

Using a decentralized approach was not a real option in many other countries because telephone systems belonged to national PTTs.[79] Today, however, this type of strategy is increasingly viable. Given global pressures for telecommunications privatization, as well as technology advances and network unbundling, it is again feasible to deploy communication technologies on an ad hoc and customized basis. In developed countries, large businesses were the first to pursue this strategy by setting up private networks to meet their own, specialized needs. Developing countries can similarly employ such an approach to serve users in small communities and rural areas.

Taking advantage of technology advance and the wider range of choices now available, many developing countries are already deploying less costly communication systems. In Asia-Pacific and Latin America, for example, countries are increasingly using very small aperture terminals (VSATs) to provide both public and private services (see figure 1-5).[80] In Tibet and other areas of the Pacific, the cost of providing VSAT is being reduced by using mesh networks that do not require the use of a central hub because the switching function is incorporated into each earth station.[81] Systems such as these can support voice traffic, facsimile, and low-rate data transmission. Moreover, between four and 40 channels can be provided at each site, depending on a community's demographics. Using an international gateway in Shanghai, calls made on such phones in Asia can be routed via undersea cable to Hawaii, and from there to any place in the world.[82]

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[77] Malcolm Willey and Stuart Rice, *Communication Agents and Social Life* (New York, NY: McGraw Hill, 1935).

[78] Andrew Davis, *Telecommunications and Politics: The Decentralized Alternative* (New York, NY: St. Martin's Press, 1994).

[79] Ibid.

[80] "Satellite Communications in Developing Countries," *Satellite Communications*, September 1994, p. 18; see also Elsa Savedra, "The Rise of Solidaridad: A System 25 Years in the Making," *Satellite Communications*, December 1994, pp. 20–21; and Ray Markets, "In Support of Latin American Economies," *Satellite Communications*, July 1994, p. 30.

[81] "The Tibetan Connection," *Satellite Communications*, January 1994; and Carol A. Politi, "Pacific Communications: Voice and Data Networking Via VSAT," *Satellite Communications*, February 1994, pp. 31–32.

[82] Ibid.

BOX 1-12: The Deployment of Telephony in the Rural United States

When the Bell patents expired in 1894, American farmers and local entrepreneurs took it upon themselves to provide telephone services to their communities, relying almost exclusively on local capital and labor. These "independent" companies took a variety of forms. In local villages, for example, they were often established by doctors or other local professionals. In rural areas, such lines were generally set up by farmers who depended, almost exclusively, on subscriber contributions.[1] Expenses were kept to a minimum because local farmers built these networks using their own materials and tools. When necessary, they purchased equipment from independent manufacturers and through mail order catalogs distributed by such firms as Sears and Roebuck and Montgomery Ward. Having built their own networks, these farmers had little trouble maintaining them. Problems did arise, however, when farmers resorted to low-quality equipment and poles, which sometimes included barbed wire and fence posts.[2] Nevertheless, these bottom-up efforts were a great success. By 1917, for example, the state of Iowa had more phones on farms and rural residences than any other state in the union.[3]

These local telephone companies were organized in a variety of fashions. Systems that were set up to provide private service generally consisted of a single line owned and shared by a small group of people, and operated on an intercom basis. Privately owned commercial systems and commercial stock companies, although owned locally, were set up on a profit seeking basis. Mutual stock companies, which limited the sale of shares to users, were organized informally, their members paying a prorated share of capital expenditures, maintenance, and improvement fees. Farmer lines were typically organized as purely private or mutually owned systems. To join the Liberty Telephone Company in 1910, for example, one had to pay an upfront fee of $25; provide a telephone, a pole, and some labor; as well as pay a flat annual fee of $7 for service.[4]

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1 Dale Hatfield, "Speeding Telephone Service to Rural Areas: Lessons From the Experience in the United States," occasional paper (Washington, DC: The Annenberg Washington Program, Communication Policy Studies, Northwestern University, May 1994). See also David Joshua Gabel, *The Evolution of a Market: The Emergence of Regualtion in the Telephone Industry of Wisconsin* (Madison, WI: University of Wisconsin. 1987).

2 Roy Alden Atwood, *Telephony and Its Cultural Meanings in Southeastern Iowa*, (Iowa City: Univeristy of Iowa, 1984).

3 Hatfield, op.cit., footnote 1, p.4

4 C. W. Meyer, "How We Built a Home-Owned Farmers Telehphone LIne," *Telephony*, Nov. 16, 1912, as cited in Hatfield, op.cit. footnote 1.

SOURCE: Office of Technology Assessment, 1995.

In other countries, such as India, fixed cellular radio systems are often used.[83] These radio-based systems are easier to deploy than wireline services, and they have lower up-front investment costs, which can be shared among subscribers. They can, moreover, be deployed on a step-by-step basis, with new cells added in response to growing demand. Because radio technology is more reliable, such systems also have lower maintenance costs.[84] To send data alone, digital radio can be used in conjunction with low earth orbiting satellites.[85] And, in a somewhat more novel fashion, rural telephone service can be provided by using telepoint technology in conjunc-

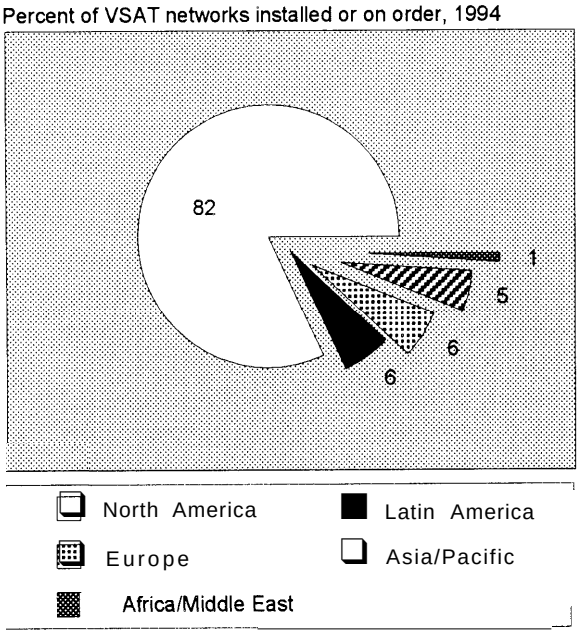
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83 Fixed cellular access systems have now been deployed in over 40 countries. Unlike mobile cellular systems, fixed cellular does not require the complex tracking and switching needed to trade and hand off conversations as users move from one cell to the next. Jean-Philippe Haag, "Fixed Cellular Solutions for Wireless Access," *Telecommunications*, December 1994, pp. 57–61; see also Neil Weinstock, "Leapfrog," *World Trade*, vol. 6, No. 19, November 1993, pp. 61–63.

84 Rudi Westerveld and Ramjee Prasad, "Rural Communications in India: Using Fixed Cellular Radio Systems," *IEEE Communications Magazine*, October 1994, pp. 70–74.

85 Joe Sedlack, "Connecting Africa to the Rest of the World," *Satellite Communications*, September 1994, p. 26.

FIGURE 1-5: International Distribution of VSAT Networks



SOURCE: 'Satellite Communications, April 1994.

tion with handsets and paging equipment to notify users of incoming calls.[86]

Communication costs can also be contained by serving individuals on a joint basis. Public phones, for example, can be set up at some strategic location within a community. Or, alternatively, a local business equipped with a phone might be willing to share access, given some concession from the community or the provider.[87] A telephone located in a shop or school will probably be within walking distance of most inhabitants because rural homesteads are generally located within or close to the center of a village.[88] These shared phone centers need not be limited to providing voice alone. Some, for example, now provide multimedia media applications such as remote learning (see box 1-13).

For delivering more costly or sophisticated services, networks might be terminated in communication centers where they can jointly support small and medium sized local enterprises, teleworking, long distance learning, public administration, remote access to health care, etc. For individual phone service, inexpensive public telephone booths might also be provided. Delivering services to a community center can produce a number of synergisms, stimulating both local enterprise as well as the demand for telecommunications services. This "telecottage" approach has a long history in Norway and Sweden, and it has been used more recently in countries such as Japan, Australia, and South Africa with considerable success.

In the future, national governments will no longer be the sole network and service providers in Third World rural communities. Increasingly they are being joined and/or bypassed by businesses, research organizations, and nonprofit groups, which are extending their networks to all corners of the earth. In Africa, for example, the nonprofit organization SatelLife uses UoSat 3 in conjunction with HealthNet to provide information to African medical schools and medical centers. To support this system, SatelLife has established ground stations in Eritrea, Ethiopia, Kenya, Mali, Mozambique, Niger, Tanzania, Uganda, Zimbabwe, and Zambia.[89] Similarly, Volunteers in Technical Assistance (VITA), a nonprofit organization founded in 1959, uses communication technologies to promote sustainable economic and human development in developing countries (see box 1-14).

Efforts by national governments, businesses, and nonprofit groups are playing an important role in advancing the deployment of technology and services to Third World rural communities. The impact of their networking efforts on economic development and rural life may be some-

86 Bruce, et al, op. cit., footnote 54.

87 M.L. Morris and S.E. Stavrou, "Telecommunication Needs and Provision to Underdeveloped Black Areas in South Africa," *Telecommunications Policy*, September/October 1993, p. 53.

88 Ibid.

89 Sedlack, op. cit., footnote 77.

BOX 1-13: The Taos Community Network

Founded in Taos, New Mexico, La Plaza Telecommunity was recently recognized by the National Information Infrastructure Task Force as one of the top six community projects in the United States. La Plaza provides residents of the Taos area with free dial-in access to a centralized UNIX server connected to a 28.8K modem bank. The La Plaza server is in turn linked to two computer labs and a Telecommunity Center where users without personal computers and modems may access the Internet via a T1, or 1.5 Mbit/sec, connection. [1]

Currently, 15 percent of the local calling area population use La Plaza to access such information as a community calendar with the activities of local civic, religious and recreational groups, information on adult education, employment opportunities from the New Mexico Department of Labor and other sources, tourist attractions, local government initiatives and local health and business resources. The widespread availability of such information opens new opportunities for participation in local government, greater cooperation among public and private organizations and the stimulation of new businesses. Employees and volunteers of La Plaza are also providing local residents with valuable training in the use of the network and in the use of the Internet. La Plaza was founded through the cooperation of several individuals and organizations including the University of New Mexico-Taos Education Center, Los Alamos National Laboratory, the Fielding Institute, Apple Computer, and several other corporate sponsors.

1 Patrick J. Finn and Cyd Strickland, "Community Networking: Bringing Communications On-line," La Plaza Telecommunity Foundation, Inc., Taos, New Mexico.
SOURCE: Office of Technology Assessment, 1995.

what limited, however, to the extent that they are "external" to the community and that users are relatively passive in relationship to them.[90]

An alternative approach to network deployment in Third World rural communities, which would probably have a much broader social and economic impact, is to develop local systems, from the bottom up, much like those developed in the rural United States and Northern Europe at the turn of the century.[91] Although such networks may require initial support and assistance, they would offer a number of benefits from the standpoint of foreign aid goals and the policy criteria identified above.

Supporting such networks, for example, would not be excessively costly, especially if the technologies used could be deployed in stages as demand increased. Any support, moreover, would be temporary, since demand will probably cover costs over the long run. World Bank studies show that the demand for such service is relatively inelastic; consumers have been shown to be willing to pay for basic services, even when prices exceed those found elsewhere.[92] Even greater demand can be anticipated if rural residents participate in network development, familiarizing themselves with the opportunities afforded and customizing systems to meet their needs.

Taking advantage of local labor and capital, the promotion of bottom-up networks can also foster entrepreneurship, which is essential for economic growth, as well as facilitate the trans-

[90] S.E. Goodman, L.I. Press, S.R. Ruth and A.M. Rutkowski, "The Global Diffusion of the Internet: Patterns and Problems," *Communication of the ACM*, vol. 37, No. 8, August 1994, p. 30.
[91] Dale Hatfield, "Speeding Telephone Service to Rural Areas: Lessons From the Experience in the United States," occasional paper (Washington DC: The Annenberg Washington Program, Communication Policy Studies, Northwestern University, May 1994).
[92] "Investing in Development," *The Economist*, June 25, 1994, p. 70.

BOX 1-14: Volunteers in Technical Assistance (VITA)

VITA's global communication system VITACOMM is composed of three different communication systems that provide communication and data to areas not served by traditional telecommunication infrastructures: VitaSAT, a low earth-orbiting satellite system; VitaPac, a terrestrial digital radio system; and VitaNet, a personal computer-based bulletin board mailing system. These three systems provide the foundation for much of VITA's development activities. For example, the Kibidula Farm Institute, an agricultural training center in the remote southern highlands of Tanzania, is two hours away from the nearest phone. Since August 1993, however, the Institute has been able to transmit data on a daily basis to its offices in the United States using a solar-powered earth station and VITA's low earth-orbiting satellite system. PLAN International, a nongovernmental organization that provides tutoring and financial assistance to 1,400 children in Sierra Leone, also uses VitaSat for data communication with its home office in Rhode Island.

SOURCE: Office of Technology Assessment, 1995.

fer of technology expertise.[93] In some cases, where appropriate technology is used, the local production of some network components may even be encouraged. Absent such technology transfer, infrastructure projects will probably fail over the long term owing to lack of maintenance and neglect.[94]

Building local networks can also serve to strengthen local administrative and political competence, thereby fostering greater decentralization of governmental authority. In many developing countries, the authority to tax and to distribute social services has traditionally been concentrated at the national level.[95] As a result, local governments, as well as community organizations, have lacked the financial resources and political capital required to establish countervailing bases of political power. Cooperating to build local communication networks, community residents may not only develop the skills necessary for political participation, even more important, they can generate the type of "social capital" that leads to cooperation in other areas of community life (see chapter 2).

Given this potential to strengthen local communities, one problem that may arise in establishing bottom-up networks is a political one. If, for example, governments in developing countries continue to jealously guard their monopolies, community networks may lack the means for interconnection with the public switched network. This possibility may be less likely in the future, however, because of the trends towards liberalization and privatization. But if rural communities are faced with such situations, some mutually advantageous arrangements will need to be worked out. National providers might agree, for example, to franchise the development of portions of the network to rural communities. And, if necessary, agreements might be made to allow national providers or privatized monopolies to subsequently acquire rural networks in exchange for some form of equity ownership.[96] Aid policies might be designed to encourage such arrangements.

[93] As described in *Human Development Report 1993*, "Some of the most effective contributions as a result of decentralization come from local labor and materials. In the Baglung district of Nepal, local committees working under the auspices of village councils built 62 bridges with little outside help, covering the whole district in five years They used local materials and artisans, and no one was paid. Each bridge cost only a quarter of what the central government would have spent, and was built three to four times faster." op. cit., footnote 13, p. 75.

[94] According to the United Nations Development Program, the local involvement and training in 34 village water projects was significant in accounting for their long-term success. Ibid.

[95] Ibid., pp. 65–73.

[96] Bruce, et al., op. cit., footnote 54, p. 465.

Targeting and Leveraging All Available Resources

Reflecting the growing appreciation of the role communication technology can play in fostering economic development, there are today a number of forces promoting its greater diffusion. These activities are both public and private, national and multinational, trade-related and aid related. Telecommunications-related aid policies that are designed to leverage all these complementary forces are bound to be the most cost effective. Equally important, they will probably have a synergistic effect resulting from many positive externalities. Communications and economic development serve not only to foster one another, they also feed on themselves.

Alluding to these possibilities, Vice President Gore—speaking to the International Trade Union (ITU) World Development Conference held in Buenos Aires in March 1994—noted that the time was right "to bring all the communities of the world together via a planetary information network." Calling on legislators, regulators, and business executives to cooperate in building and operating this global information infrastructure (GII), he urged conference delegates to promote policies in support of private investment, competition, and flexible regulations promulgated by independent regulators.[97]

Vice President Gore's vision of bringing all of these forces together in support of a global information infrastructure is very apt. It comes at a time when all major donor countries—struggling with trade and budget deficit problems—are being called on to reduce foreign aid.[98] Such pressures are particularly intense in the United States, which accounts for one-fifth of all government foreign aid.[99] Gore's announcement reflects, moreover, the growth of private investment in Third World countries, which is now three times greater than the aid provided by foreign governments, totaling $179.9 billion in 1994.[100]

Speaking to the United Nation's social summit held in Copenhagen, Vice President Gore reemphasized the need to move beyond the present institutional framework for providing aid. Noting that foreign assistance has not always been used in accordance with the purposes for which is was provided, Gore posited that, within five years, nearly half of all aid provided by the U.S. Agency for International Development would be channeled to organizations instead of Third World governments.

Other major donors agree that steps must be taken to assure that foreign assistance is used more effectively. Many have suggested that new institutional methods and criteria such as targeting, decentralization, appraisal, evaluation and monitoring may need to be adopted. The targeting of women in allocating assistance is considered to be essential by all.[101]

The prospect for developing new types of cooperative arrangements is especially promising in the case of telecommunication-related aid. Most, if not all, of the potential participants have something to gain by working together. Not surprisingly, therefore, there are already a growing number of telecommunications-related cooperative efforts underway that, drawing on a broad range of institutional resources, seek to achieve

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[97] "Gore Backs Global Infrastructure at ITU Meeting," *Telecommunication Reports*, Mar. 28, 1994, p. 24.

[98] In 1994, aid to developing countries dropped by 1.8 percent, after falling 5 percent the year before. These declines reflect in part the cut in U.S. aid. "Aid to Developing Nations Shrinks," *The Wall Street Journal*, June 29, 1995, p. A12.

[99] U.S. foreign aid totals approximately $13 billion a year, about half of which is devoted to programs relating to health, family planning and economic development and administered by the U.S. Agency for International Development. Viewed in terms of per capita gross domestic product, the US devotes only .15 percent of GDP to foreign aid, far less than all other industrial countries, and this amount has continued to decline over the past several years. Barbara Crossete, "Foreign Aid Budget: Quick, How Much? Wrong," *The New York Times*, Feb. 27, 1995, p. A6.

[100] "Private Investment to Poor Nations Hits a Record High at World Bank," *The Washington Post*, Associated Press, Jan. 23, 1995, p. A14.

[101] "Governments Agree That Targeting and Monitoring of DOA Could Increase Benefits to the Poor," UNCTAD Press Release TAD/INF/2554, June 16, 1995.

complementary national, international, and private sector goals.

One such initiative, for example, is WorldTel, an innovative investment venture that was recently launched by the International Telecommunications Union (ITU). Organized entirely around business principles, WorldTel was set up to help businesses identify and execute profitable telecommunications investment opportunities in developing countries. Private sector support for the plan spans the globe, including companies such as AT&T, Ameritech, Sprint, Cable and Wireless (United Kingdom), NEC (Japan), Nokia (Finland), Teleglobe (Canada), Telekom Malaysia, and Telstra (Australia). A number of banks have also expressed interest in WorldTel, which—initially capitalized at $30 million to $50 million—expects to realize real rates of return on equity of up to 25 percent or more. By safeguarding investor interests, WorldTel seeks to attract funds to high-risk countries where telecommunications investment would otherwise be unlikely. Prime clients will be those Third World countries that have regulatory and business environments conducive to commercially viable partnerships. As venture partners, investors will contribute information and expertise as well as funds. Focusing on wireless technology, most projects will be carried out on a build, operate, and transfer basis. If successful, these joint ventures will generate new markets, thus benefiting both First and Third World nations alike.[102]

Nonprofits are similarly working with governments and businesses to promote development goals through networking. For example, the Caribbean/Latin American Action (CLAA), a nonprofit organization operating in Latin America and the Caribbean, is setting up a Telecommunication Task Force intended to improve access to health care throughout Latin America and the Caribbean. The task force's first initiative is a pilot telemedicine project that will examine how better communication among rural health clinics and six hospitals throughout Costa Rica might improve rural health care. AT&T has supported this project by donating several of its Picasso Still-Image Phone systems, which allow doctors to transmit images, records, and x-rays over ordinary telephone lines. CLAA is also working with the U.S. Chamber of Commerce's Western Hemisphere Telecommunications Committee, the Pan American Health Organization, the Inter American Telecommunications Commission (CITEL), the World Bank, and other organizations to expand the pilot project into an "Americas HealthNet" that would connect rural health centers throughout the region to the Internet, thus allowing health professionals to access medical databases and other health resources throughout the world.

The CLAA has also helped to form AgroAmericas, Inc., a nonprofit association of agricultural and information technology companies, which was established to increase agricultural trade in the Western Hemisphere through data networking. AgroAmericas seeks to stimulate growth and productivity in this important sector by first establishing a Hemispheric Electronic Network, AgriNet Americas, that provides accurate and timely trade information to agricultural companies of all sizes and from all sectors. Sprint Corp. and the Inter-American Institute for Cooperation on Agriculture are important contributors to the initiative, which will eventually provide member companies access to trade databases from the Organization of American States and the U.S. Department of Agriculture, as well as historical trade statistics, tariff schedules, current prices, and information on individual import/export companies.

A number of projects supported by USAID are similarly designed to promote cooperation among public and private sector telecommunication stakeholders. With grants from USAID, for example, the National Telephone Cooperative Association (NTCA) has launched an international program to promote rural telephony in countries such as Hungary, the Philippines,

[102] *Telecom Highlights International,* Feb. 15, 1995, p. 6; and Karen Lynch, "Telcoms Funding Body Set," *Communications Week International,* Feb. 6, 1995, p. 3.

Micronesia, Bolivia, Poland, the People's Republic of China (non-USAID funded), and Tanzania.

In promoting rural networks, NTCA generally works in three stages beginning with the education of appropriate government leaders and policy makers about the benefits of local networks. Government champions are needed to assure that local groups can reach an appropriate and timely interconnection agreement with national regulators. Secondly, NTCA identifies local institutions and community leaders who want to participate. Key supporters must garner community support and build a consensus for the cooperative's ownership structure and operational guidelines. NTCA provides training and assistance in all aspects of network development—the preparation of financial and technical feasibility studies, telecommunications management, engineering, and actual equipment installation. Then, after performing a detailed country assessment of the financial, regulatory, political and social environment, and the status of existing communication and other infrastructure, NTCA works to foster additional cooperatives throughout the country.

There are a number of benefits to be gained from collaborative efforts such as these. By working with, and gaining the support of all relevant players, it is possible to circumvent many potential and unforeseen road blocks. With First World businesses and Third World government organizations and local institutions cooperating as partners in joint ventures, the potential for technology transfer and the sharing of business expertise is great. At the same time, the need for monitoring and evaluation is likely to be less relevant because projects will be held more accountable to the conventional business standard—the bottom line. Moreover, by substituting business personnel, researchers, and members of nonprofit organizations for traditional aid field workers, the costs of projects can be more easily contained.

By collaborating to promote information networking for development purposes even greater gains can be made. Network deployment encourages social, economic, and political interaction, which in turn stimulates network development and deployment. When networks are subsequently linked to other networks, the benefits grow proportionately. The key is to plant the seeds and foster their germination.

These network seedlings can take the simple form of an Internet host, or a regional e-mail network such as that set up by CERPOD—the Center for Applied Research on Demography and Development—in Bamako, Mali, to communicate with colleagues in other Sahelian countries.[103] It was, in fact, this type of "demand pull" pattern of deployment that characterized the evolution of Costa Rica's network, which has now become a regional hub providing services to other Central American countries. Grants and other donations were sought to build the infrastructure on an incremental basis, in response to growing demand. Similarly, in Zambia, the network that was originally built by the deputy minister of health to connect to the provincial hospitals was gradually extended to other users, so that today it is one of the most successful networking efforts in subequatorial Africa.[104]

One way to foster such kinds of collaborative efforts would be to require aid applicants to include specific plans for collaboration, developed jointly with all the participants, as part of their project proposals. Because the transaction costs entailed in identifying, matching, and negotiating such collaborative agreements will probably be prohibitive for small and/or local groups seeking assistance, aid officials might focus greater attention on brokering such relationships. One useful tool would be an electronic networked database—routinely updated and incorporating feedback from previous aid and telecommunications projects—that could help development groups to identify and communicate with collaborators, working together in much the same fashion as those engaged in electronic commerce.

[103] *Telecommunications of the ACM*, August 1994, vol. 37, No. 8, p. 28.
[104] Ibid.

Foreign Aid Policy: The Lessons Learned 2

Foreign aid has a very long and distinguished tradition. In the fifth century B.C., for example, the Delian League—an early defense support agreement—provided financial aid to Athens, so that the Athenians could build a navy capable of containing Persian imperial ambitions, thereby protecting the entire region.[1] Centuries later, Napoleon similarly used money to gain allies to support his military ventures across the European continent.[2] Likewise, the French government, under Louis XVI, provided aid to American revolutionaries not for altruistic reasons but rather to strengthen France's international position vis a vis Great Britain.[3]

This centuries-old practice of granting aid to foreign governments in order to shore up a state's own situation reflects a basic awareness of, and appreciation for, the essential interdependence of peoples across the globe. It suggests, moreover, that foreign aid can perhaps best be viewed not as an end in and of itself, but rather as a basic and well-tried, policy tool that can be used to foster a range of national goals in the international arena. Whether foreign aid is the appropriate foreign policy tool in any given instance will depend, in part, on world events and the configuration of the world order.

Using foreign aid as a policy tool has special relevance for today. Never before has the world been so integrated, or have states been so interdependent. Now that advanced communication and information networking technologies—operating in real time—span the globe, gyrations in the Japanese stock market are experienced throughout the world within one business day; prior to the development of the transatlantic cable in 1866, it took six weeks for stock prices to clear between London and New York.[4] Likewise, with instantaneous worldwide news coverage and

[1] Delos—the smallest of the Cyclades islands, which are located in the Aegean sea—was a major commercial center as well as the treasury of the Greek confederacy during the Persian wars in the late sixth century B.C. See, for a discussion, Rex Warner, trans., Thucydides, *History of the Peloponnesian War* (London, UK: Penguin Books, 1954), p. 92.

[2] W.W. Rustow, *Eisenhower, Kennedy, and Foreign Aid* (Austin, TX: University of Texas Press, 1985), pp. 75–76.

[3] Robert Middlekauf, "The Revolution Becomes a European War," *The Glorious Cause: The American Revolution, 1763–1789* (New York, NY: Oxford University Press, 1982), chap. 7.

[4] Kenneth D. Garbade and William L. Silber, "Technology, Communication, and the Performance of Financial Markets 1840–1975," *Journal of Finance*, vol. 33, June 1978, pp. 819–832.

rapid diffusion of technologies such as the Internet, the media can now determine whether an issue—such as the famine in Somalia or the revolt in Chiapas, Mexico—is placed on the international political agenda.

Complicating matters, the collapse of the Communist regimes in the Soviet Union and Eastern Europe has rendered the old world order based on a Cold War balance of power obsolete, while a new basis for world stability has yet to emerge.[5] Lacking the threat of a major nuclear war, the incidence of local quarrels and conflagrations has already increased. The year 1992, for example, bore witness to more than 200 wars.[6]

At the same time, the number of highly complex and unprecedented social and economic issues that need to be addressed at the global level is on the rise. Just as national boundaries are increasingly penetrable to the flow of commerce, ideas, and people, so too these boundaries can no longer constrain the spread of social, economic, and environmental problems.[7] In the future, the dangers to national security may stem less from the outbreaks of war among nation states, and more from the disintegration of civil society and the depletion of the world's human and environmental resources.[8]

As in the past, policymakers can look to foreign aid as one way of coping with these highly complex and unprecedented foreign policy issues. Despite years of experience, however, designing successful policies to address such problems continues to be fraught with difficulties. The relationship between foreign assistance and national goals such as national security, political stability, and economic development is by no means straightforward. Moreover, all too often policymakers have drawn the appropriate lessons from one set of foreign aid experiences, only to have had the situation change so that new solutions and approaches are required.

This chapter reviews the lessons to be learned from past U.S. efforts to employ foreign aid policy to achieve national goals. On the basis of this analysis, it suggests a number of criteria that policymakers will need to take into account in developing telecommunication-related approaches for providing foreign assistance.

FOREIGN AID AS A POLICY TOOL: THE IDEAL CASE

To understand how telecommunication-related aid policies might mutually serve and perhaps even reinforce foreign policy and foreign trade goals, it is helpful first to consider the foreign aid process—in the abstract—as an "idealized" system in which foreign aid serves as a policy tool that aims to promote national security and international economic objectives (see figure 2-1). By examining how the process is intended to work—the assumptions on which it is based and the conditions required for success—it is possible to identify and analyze potential problem areas, as well as the points in the process where telecommunication and information might best contribute.

Foreign Aid Goals and Policy Tools

Over the past 50 years, the United States has employed foreign aid to achieve a number of national goals. Aid has been provided, for example, for humanitarian reasons; to promote worldwide security and political stability; to support economic development and growth in trade; to maintain the integrity of the international monetary system; as well to foster democracy and protect the environment (see table 2-1). Although program emphasis has changed over time and in

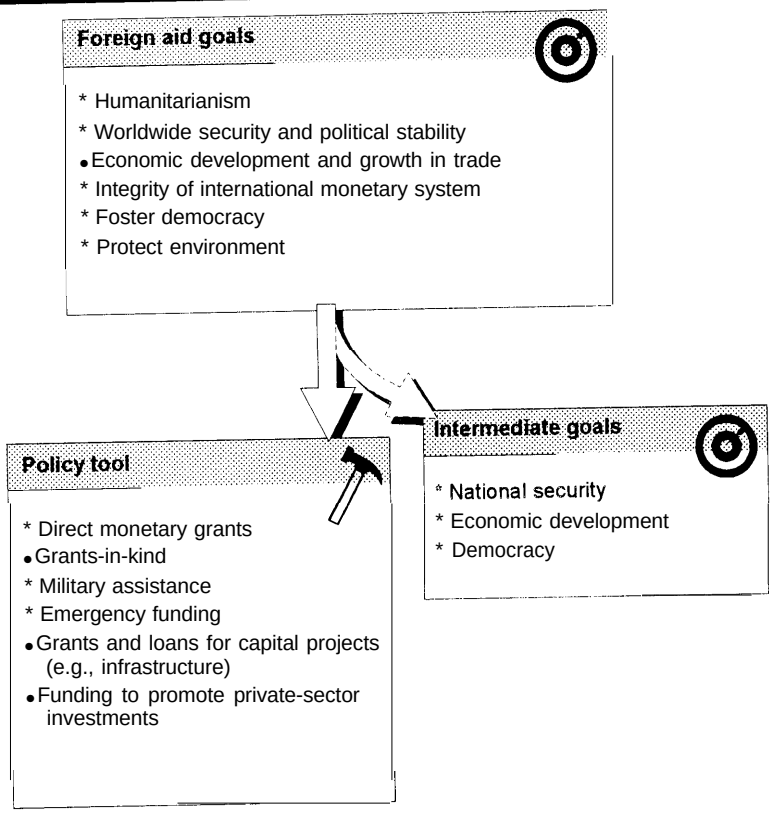
[5] *The Quest for World Order, Daedalus*, Journal of the American Academy of Arts and Sciences, summer 1995; see also *Current History, Global Security*, entire issue, May 1995.

[6] Benjamin Barber, "Jihad vs. MacWorld," *The Atlantic Monthly*, March 1992, pp. 53–63.

[7] Paul David Miller, "Leadership in a Transnational World: The Challenge of Keeping the Peace," National Security Paper No. 2, Institute for Policy Analysis, 1993, p. 19.

[8] See Robert D. Kaplan, "The Coming Anarchy," *The Atlantic Monthly*, February, 1994.

FIGURE 2-1: Conceptualization of Foreign A



SOURCE: Office of Technology Assessment, 1995.

response to different circumstances, the range of policy goals has remained fairly consistent.

Almost all these previous goals are echoed, for example, in the Foreign Assistance Act of 1994, which—replacing the Foreign Assistance Act of 1961—is intended to reshape the foreign aid program, linking it closer to overall foreign policy goals and the post-Cold-War international environment. This legislation incorporates six, interrelated objectives:

1. ensuring the economic competitiveness and security of the United States;
2. supporting reform in Russia and the New Independent States of the Former Soviet Union;
3. renewing and revitalizing our critical security relationships with the North Atlantic Treaty Organization (NATO) and Europe;
4. expanding economic and political cooperation across Asia and the Pacific;
5. forging an enduring peace in the Middle East; and
6. meeting the challenges to American security posed by global problems like proliferation, environmental degradation, excessive population growth, narcotics trafficking, and terrorism.

Over the years, the U.S. government has used a variety of policy tools to achieve its foreign aid goals. Included among these, for example, are direct monetary grants and grants-in-kind for humanitarian purposes and basic human needs, military assistance, emergency funding to support exchange rates in times of financial crisis, grants and loans for special capital/infrastructure-related projects, funding to insure private sector investments against excessive risks, etc. These policy tools are used, moreover, by a wide range of aid organizations—public, private, national, regional, and/or multinational alike.

TABLE 2-1: Development Ideas and U.S. Aid Rationales 1950–1990

	Ideas	Rationales
1950s	Reconstruction of Europe	Humanitarian, development, commercial
	Establishment of Bretton Woods System	Development, security
	Containment	Security
1960s	Stages: growth-stability	Development, humanitarian, security
	State-led growth	Development
	Import substitution industrialization (ISI)	Development, security
1970s	Basic needs	Humanitarian, development
	New international economic order (NIEO)	
1980s	Policy reform	Development, security, humanitarian
	Export-led growth	Development, security
	Democracy	Development, security
1990s	Broad-based & sustainable development	Economic security
	growth, democracy, environment, population	Human development

SOURCE: U.S. Congress, Senate, Committee on Foreign Relations, Subcommittee on International Economic Policy, Trade, Oceans and Environment Affairs, *Hearings on Foreign Aid Reform,* hearing, Feb. 9, 22 and Mar. 3, 1994, S. Hrg. 103-560 (Washington, DC: U.S. Government Printing Office, 1994).

Generally speaking, the choice of policy tools depends on factors such as historical interrelationships and geographic boundaries, policymakers' values and perceptions of the problem, available resources, and the mandates of funding organizations, as well as the overall political and economic context in which foreign aid organizations operate. Whether a given policy tool leads to a successful outcome is related to factors such as the worldwide economic environment; the situation and organizational context in which a program is implemented; its suitability for the task at hand; and the quality of its execution.

Achieving Intermediary Goals

As the arrows in figure 2-1 indicate, foreign aid policies are intended to promote national security and broad national economic goals indirectly, by supporting economic development, democracy, and political stability in select regions of the world. Thus, how well these tools accomplish their long-term national objectives will depend to a large degree on their ability to deal with these intermediary social, economic, and political challenges. Achieving success requires that policymakers fulfill a number of conditions, all of which are extremely difficult to meet. Policymakers must have a reasonable understanding of the process of economic development, the nature of democracy, and the impact of social and cultural forces. Moreover, they must be able to adequately identify and evaluate problems, and develop the capacity and leverage to assure that necessary adjustments are made.

Longer Term Outcomes

Worldwide economic development is intended to serve U.S. interests in at least two important, and presumably, complementary ways. Foreign aid programs, which promote economic development, aim to enhance stability in areas that are threatened by forces inimical to the values and/or security of the United States. At the same time, economic growth and development also serve U.S. economic interests. They not only foster stable worldwide economic institutions, which are required for conducting business on a global basis; they also help to generate a growing market for U.S. goods and services. U.S. environmental goals are also served to the extent that foreign aid encourages sustainable economic development.

Judging how well foreign aid has served the interests of the United States is quite difficult, given the complex set of factors involved. When viewed on a project basis, and in terms of economic measures and goals alone, foreign aid programs have generally been rated successful, exhibiting high average rates of return.[9] But ascertaining how such projects contribute to overall economic growth and development in developing countries is far more difficult.[10] Generalizations about whether or not foreign assistance contributes to the achievement of noneconomic goals—such as national security, democracy, and political stability—are even more problematic.

Clearly, all foreign assistance is not alike. The impact of foreign aid depends not only on the nature of the aid given but also on how it is used by the recipients of aid. To understand the range of possible outcomes, and the factors likely to influence them, it is necessary to look more closely—in light of past experiences—at the assumptions on which the U.S. foreign policy rationale has been based.

THE HISTORICAL EXPERIENCE

The uneven performance record of U.S. foreign aid programs is due in part to the fact that many of the assumptions on which these programs were based are, in today's context, less tenable. If communication-based foreign aid programs are to exhibit greater success, they must be founded on a solid, up-to-date rationale that incorporates the many lessons from the past.

The Marshall Plan: The Source of the Model

The U.S. foreign aid program dates back to the end of the Second World War, when world conditions generally conformed to the assumptions underlying the model outlined above. Perceiving the Soviet Union to be a major threat to both national security and the American way of life, the United States sought to contain it by bolstering the economies of countries most vulnerable to the appeals of communism. To this end, the United States invested more than $13 billion over a 5-year period, under the auspices of the Marshall Plan, to help rebuild and sustain the war-torn economies of Europe.[11]

Motivated by self-interest as well as generosity, this aid was not without conditions. Countries receiving aid had to provide matching funds in local currencies, which were to be used to improve the productive capacity of industry, agriculture, and infrastructure. U.S. administrators also advised European governments on how these matching funds should be used. In addition, each aid recipient had to agree to balance its budget, free prices (hitherto controlled), halt inflation, stabilize its exchange rate, and devise a plan for removing most trade controls.[12] Moreover, to promote West European integration, the Marshall Plan required European governments to coordinate and jointly allocate American aid through a new organization created for this purpose—the Organisation for European Economic Cooperation (OEEC), which later became the Organisation for Economic Cooperation and Development (OECD).

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[9] Constantine Michalopoulos and Vasant Sukhatme, "The Impact of Development Assistance: A Review of the Quantitative Evidence," in Anne Krueger and Vernon W. Ruttan (eds.), *Aid and Development* (Baltimore, MD: Johns Hopkins Press, 1989), chap. 7; and Roger C. Riddell, *Foreign Aid Reconsidered* (Baltimore, MD: Johns Hopkins Press, 1987), p. 126.

[10] Ibid.

[11] Anne Krueger estimates this amount to be $55.4 billion in 1991 prices, or an average annual total of $13.8 billion. See Anne O. Krueger, *Economic Policies at Cross Purposes: The United States and the Developing Countries* (Washington, DC: The Brookings Institution, 1993), p. 200; See also Alan S. Milward, *The Reconstruction of Western Europe 1945–1951* (University of California Press, 1984); and Stanley Hoffman and Charles Maier (eds.), *The Marshall Plan: A Retrospective* (Boulder, CO: Westview Press, 1984).

[12] See Michael D. Bordo, "The Gold Standard, Bretton Woods and Other Monetary Regimes: A Historical Appraisal," *Federal Reserve Bank of Saint Louis*, March/April 1993, p. 166. See also "Bretton Woods Revisited: A Gift From the Cold War," *The Economist*, vol. 332, No. 7871, July 9, 1994, pp. 69–75.

These conditions closely linked the Marshall Plan to U.S. international trade and financial policies. Attributing the outbreak of hostilities in World War II, in part, to the collapse of the worldwide trading and financial systems, the United States led the way in establishing a postwar open trading and monetary system based on a set of multilateral economic institutions. Had the European countries not had access to Marshall Plan aid, they would have been unable to conform to these requirements for openness.

The cornerstone of the new economic order was the Bretton Woods Agreement of 1944, which called for the establishment of the International Monetary Fund (IMF), the International Bank for Reconstruction and Development (IBRD), and the General Agreement on Tariffs and Trade (GATT).[13] The IMF was set up to manage the orderly transition of world currencies, by providing temporary funding to those countries experiencing severe balance of payments difficulties. Complementing this role, the IBRD (subsequently, the World Bank) was designed to promote the flow of funds to developing countries. The GATT, which was intended to be subsumed within the—subsequently aborted—International Trade Organization (ITO), was charged with trade liberalization.[14]

Together, these programs and institutions were highly successful in fostering postwar economic reconstruction. By 1950, European production levels were 25 percent higher than in 1938. And, in the three years between 1947 and 1950, agricultural output increased by one-third. During the same time, the European trade deficit fell from $8.5 billion to $1 billion.[15] In 1952, Europe generated a current account surplus and by 1955, all European currencies were virtually convertible.[16]

The United States similarly benefited from the Marshall Plan and Bretton Woods arrangements. Worldwide trade flourished in this stable economic environment. Between the years 1950 and 1960, for example, the value of world trade increased from $57 billion to $144 billion, growing faster (in real terms) than output.[17] In the same period, U.S. exports totaled 5 percent of gross national product (GNP), with 62 percent of these exports going to industrialized countries.[18] Judged, therefore, solely on the basis of U.S. trade goals, the American investment in Europe appears to have "paid off."[19]

At the same time, postwar economic arrangements also served U.S. security goals, which had become increasingly paramount in the face of a mounting Soviet threat.[20] By requiring European countries to collaborate within the OEEC, the Marshall Plan helped ameliorate potential conflicts among U.S. allies, thereby fostering European unity. Without such European cooperation, NATO—on which U.S. defense strategy in Europe depended—could never have succeeded.[21]

The United States gained, moreover, in a much more fundamental and enduring way from

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[13] Ronald I. McKinnon, "The Rules of the Game: International Money in Historical Perspective," *Journal of Economic Literature*, vol. 31, March 1993, p. 12.

[14] The General Agreement on Tariffs and Trade (GATT) was originally conceived as a holding operation until the ratification of the treaty establishing the International Trade Organization (ITO). When the U.S. Congress failed to ratify the treaty, GATT came to serve as the operational mechanism through which trade liberalization was negotiated. See Patrick Low, *Trading Free: The GATT and U.S. Trade Policy* (New York, NY: The Twentieth Century Fund, 1993).

[15] Organisation for Economic Cooperation and Development, *From Marshall Plan to Global Interdependence* (Paris, France: OECD, 1978); see also Robert Solomon, *The International Monetary System 1945–1976: An Insider's View* (New York, NY: Harper and Row, 1976).

[16] Bordo, op. cit., footnote 12, p. 166.

[17] Krueger, op. cit., footnote 11, p. 12.

[18] Ibid.

[19] As described in *The Economist*, op. cit. footnote 12.

[20] When Marshall presented his plan at Harvard University in June 1947, he left the door open to the Soviet Union and the Eastern Europeans to join the program, an offer that was turned down. As a result, the Marshall Plan came to be identified with the U.S. policy of containment. See Stephen Browne, *Foreign Aid in Practice* (New York, NY: New York University Press, 1991), p. 12.

[21] Melvyn P. Leffler, *A Preponderance of Power: National Security, the Truman Administration, and the Cold War*, (Stanford CA: Stanford University Press, 1992).

these developments. As the chief financier of postwar reconstruction, the United States was successful in influencing the economic rules of the global marketplace so that they mirrored and reinforced American economic and political values.[22] Thus, for example, participation in the GATT was made contingent on a country's acceptance of free market principles. And, on that basis, the Soviet Union and the countries of Eastern Europe were excluded from the worldwide trading system.

Because of its widely acclaimed success, the Marshall Plan served as the inspiration for U.S. bilateral aid to the developing countries.[23] As it turned out, however, the Marshall Plan model could not be easily replicated. Where conditions diverged greatly from those in Europe, it yielded some very different, and oftentimes unexpected, results. Key to the Marshall Plan's success was the sheer magnitude of the financial commitment, a mutual purpose and atmosphere of trust, the application of—what were generally agreed to be—sound economic policies, and the existence of a social and economic infrastructure capable of absorbing and efficiently allocating aid resources.[24]

Aid for Development in the Context of the Cold War

Postwar conditions in the developing world differed radically from those in Western Europe. Most less developed countries had only just achieved independence, and their leaders—however capable—were as yet untried. The task of nation building, which lay before them, was enormous. Rarely, if ever, did the geography, history, and culture of these "nations" coincide. The developing countries were, moreover, extremely poor. For the most part, their economies were agriculture based, and thus dependent on primary products for foreign exchange and imports. Low standards of living, low savings rates, high illiteracy rates, and relatively low life expectancies were also common. These problems were of such magnitude, in fact, that many leaders in the developing world believed that they could only be overcome given very rapid economic development.[25]

This diagnosis was shared in the West. Impressed by the results of the Marshall Plan, Americans, in particular, were generally sympathetic to the notion of providing support to developing countries. Most people agreed, moreover, that what was needed was the transfer of capital and technology expertise. President Truman captured this vision in his 1949 inaugural address, when, as his fourth major point, he called for a technical assistance program for developing countries.[26]

The altruistic motives that inspired Truman's Four-Point Program were soon superseded, however, by national security concerns. By 1953, $4.5 billion—that is to say, 70 percent—of all U.S. aid appropriations went to direct military aid; another 20 percent took the form of economic assistance to less developed military

[22] Robert Gilpin, *The Political Economy of International Relations* (Princeton, NJ: Princeton University Press, 1987), pp. 131–134; and Charles W. Kelley and Eugene R. Wittkopf, *American Foreign Policy: Pattern and Process, 3rd ed.* (New York, NY: St. Martin's Press, 1987), p. 151.

[23] As described by Paul Hoffman, an early administrator of the Marshall Plan, "We have learned in Europe what to do in Asia, for under the Marshall Plan, we have developed the essential instruments of a successful policy in the arena of world politics." Paul G. Hoffman, *Peace Can Be Won* (New York, N.Y.: Doubleday, 1951), p. 130. Writing from an historical perspective, Albert Hirschman concurs. As he describes, the Marshall Plan convinced policymakers that "the infusion of capital helped along by investment planning might be able to grind out growth and welfare all over the globe." A. Hirschman, "Rise and Decline of Development Economics," in M. Gersovitz, et al. (eds.), *The Theory and Experience of Economic Development* (London, UK: Allen & Unwin, 1982), p. 380.

[24] Browne, op. cit., footnote 20, p. 13.

[25] Krueger, op. cit., footnote 11.

[26] David McCullough, *Truman* (New York, NY: Simon and Schuster, 1992), p. 729–731. See also Gregory A. Fossedal, *Our Finest Hour: Will Clayton, the Marshall Plan, and the Triumph of Democracy* (Stanford, CA: Hoover Institution Press, 1993).

allies.[27] Once the Cold War had been brought to a standstill in Europe, hostilities shifted to East Asia. In June 1950—the same year that the U.S. Congress passed the Act for International Development—North Korea invaded South Korea. With the Soviet Union aiding the northern half of the peninsula and the United States fighting on behalf of the south, U.S. foreign assistance was quickly channeled to the immediate military objective of halting the Communist advance.[28]

When the fighting ended, the Cold War shifted to more ideological battlegrounds, where foreign assistance again played a critical role. Seeking to extend their spheres of influence at one another's expense, the United States and the Soviet Union sought to curry the developing countries' favor by proffering aid. Asia was a key target of this competition. Including countries such as India, Indonesia, Pakistan, the Philippines, and Sri Lanka, which together accounted for a large proportion of the developing world's population, Asia was considered to be more strategically situated than the regions of Africa or Latin America.

Despite such superpower overtures, the newly independent countries were not successfully swayed by either camp. Meeting in 1955 at the Afro-Asian Conference held in Bandung, Indonesia, they announced their joint decision to remain nonaligned. Whether intended or not, this decision served to raise the ante for granting foreign aid. Thus, for example, the United States increased its aid to Indonesia, on learning that the Indonesian government had accepted a $100 million loan from the Soviet Union. Similarly, the Indian government, by remaining nonaligned, was able to procure funds and credits to finance its Second Five-Year Plan from the governments of the Soviet Union, the United States, and Western Europe alike.[29]

The Cold War thus set a tone for U.S. development assistance that survives to some extent today. Judged in the context of the period, and by the overriding goal of containing communism, U.S. aid policy was certainly a success. Measured in terms of Truman's Four Point Program, however, U.S. aid did not have its intended effect. In fact, in some cases, it proved detrimental. When foreign loans increased a developing country's liability without improving its growth potential, they served to make the recipient country further dependent on aid.[30]

The contrast between U.S. aid policy in Europe and in the developing countries is striking. In devising the Marshall Plan the United States worked closely with European countries to develop a workable aid package that took into account social and economic factors. In fact, because of the importance attributed to social and economic factors, the United States made aid to Europe contingent on European cooperation and on fundamental economic reforms. In the developing countries, no similar dialogue ever took place. Equally, if not more important, the basis for granting aid to developing countries was political correctness rather than economic soundness.

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[27] Subsequently, until the early 1960s, all U.S. foreign aid was administered by the Mutual Security Agency, which specified that aid would be contingent on whether it "strengthened the security of the United States." In keeping with these new guidelines, the United States had, by the end of the war, not only invested $50 billion in South Korea's democratic future; it had also deployed more than two million troops there. David Louis Cingranelli, *Ethics, American Foreign Policy, and the Third World* (New York, NY: St. Martins Press, 1993), p. 138; and Browne, op. cit, footnote 20, p. 134.

[28] According to Cingranelli, "Between 1946 and 1950, about 90 percent of the bilateral aid provided to less developed countries was for economic development. With the outbreak of the Korean War in 1950, military aid began to dominate accounting for two-thirds of the total by 1953." Ibid.

[29] The developing world's policy of nonalignment also had its downsides. Using the stick as well as the carrot, the United States denied assistance on a number of occasions for political reasons. Thus, for example, when Egypt began to establish closer ties with the Soviet bloc in 1955, and signed an arms agreement with Czechoslovakia in 1956, the United States canceled its offer to help finance the Aswan Dam, as did the United Kingdom and the World Bank—the only other sources of noncommunist funding. Browne, op. cit., footnote 20.

[30] This is a criticism that has been made from all sides of the political spectrum. For an overview, see Riddell, op. cit.; footnote 9.

An Expanding Foreign Aid Environment

By the late 1950s, the rigid bipolar pattern of distributing aid began to erode. New kinds of foreign aid programs and rationales were introduced to take into account the growing evidence and data on economic development. Similarly, new players with their own agendas were becoming involved, including among them a number of multinational organizations. The developing world was also emerging as a political force in its own right. Given this increasingly fluid international political environment, the United States had less freedom to link foreign aid to foreign policy and trade goals or leverage to control policy outcomes.

The narrow choice of foreign aid tools reflected a lack of understanding and empirical evidence about the nature and process of economic development.[31] Given little experience with the newly independent countries, American policymakers attributed their poverty to a lack of domestic capital required to fuel industrialization. Accordingly, they concluded that these countries merely needed foreign capital. Because the Congress was generally opposed to aid for purposes other than military security, however, most aid was provided on a loan rather than a concessionary basis.[32]

When industrialization was not immediately forthcoming, funders recognized that Third World countries could not borrow and repay loans as did developed countries. The IBRD, for example, lent money at near market interest rates, so it was only natural that—especially in the early years—Japan and the countries of Europe were its major clients. To meet the Third World's special needs, the United States—in 1959, at the end of the second Eisenhower Administration—helped to establish two new, but moderately funded, aid organizations—the Development Loan Fund (DLF), and the International Development Association (IDA), later incorporated into the World Bank. With an initial subscription of $900 million, IDA provided concessionary development loans to low income countries.[33]

Over time, policymakers also began to acknowledge that financial capital, by itself, was insufficient to address the myriad of problems facing the developing world.[34] In this sense, the Marshall Plan proved inadequate as a model. In contrast to postwar Europe, where the major problem was one of reconstruction, the newly independent nations had to build social and economic institutions from scratch. U.S. policymakers soon came to realize that, if capital were to be used effectively in the developing countries, it would have to be linked to the transfer of technical and administrative knowledge and skills. At the same time, the United States initiated a major food assistance program, authorizing the sale of surplus grains to developing countries at prices below costs in return for local—and more often than not—inconvertible currencies.[35]

A major shift in U.S. foreign aid policy occurred in the early 1960s, with the advent of the Kennedy Administration. A long time advocate of foreign aid, Kennedy was the first President to make Third World economic development a prominent goal of U.S. foreign policy.[36] Speaking in Congress in 1959 in support of aid to India, Kennedy had—while still a Senator—equated the importance of the "economic gap" with that of the "missile gap."[37]

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[31] As described by Krueger and Ruttan, "Until World War II, growth was not a conscious policy objective even in most industrial countries. Insofar as some governments attempted consciously to stimulate economic growth, little or no systematic knowledge was available to guide their efforts." Anne O. Krueger and Vernon W. Ruttan, "Development Thought and Development Assistance," in Krueger and Ruttan, op. cit., footnote 9, p. 13; and David A. Baldwin, *Economic Development and American Foreign Policy: 1943–1962* (Chicago, IL: University of Chicago Press, 1966).

[32] Krueger and Ruttan, op. cit., footnote 9, p. 15.

[33] Cingranelli, op. cit., footnote 27, p. 139.

[34] Krueger, op. cit., footnote 11, p. 28.

[35] This program was established in the mid-1950s under the Agricultural Trade Development and Assistance Act (Public Law 480).

[36] Cingranelli, op. cit. footnote 27, 169.

[37] Rustow, op. cit., footnote 2, p. 157.

Kennedy's speech to the Senate followed on the heels of a number of alarming incidents and events such as the crises in Suez and the Formosa Straits, as well as the roughing up of Vice President Nixon in Latin America. With the spread of military and political unrest beyond the Soviet bloc, Kennedy's arguments resonated in Congress and among the public. Also important in building the case for aid was the strong support of a number of prominent academics, who marshaled theoretical arguments to demonstrate how foreign aid might provide the necessary impetus for sustainable growth in the developing world.[38]

Building on this growing consensus, Kennedy increased funding for foreign assistance programs (most notably soft loans) early in his presidency. Equally, if not more important, he extended the goal of aid to include economic development as well as economic growth, while at the same time expanding the notion of what foreign aid programs should entail. To realize his vision of the "development decade," aid programs were to generate fundamental social and economic change in the developing world.[39] To this end, Kennedy established new and innovative programs such as the Peace Corps and the Alliance for Progress. In addition, in 1961, he highlighted the role of foreign aid, by bringing together and reorganizing programs within a new, independent agency—the U.S. Agency for International Development (USAID) (see box 2-1).[40] Enthusiasm for Third World economic development reverberated throughout the industrial world.[41] As Europeans recovered from the Second World War, they began to assume greater responsibility for the financial and administrative burden associated with foreign assistance. Thus, although the United States had accounted for more than one-half of all foreign aid throughout the 1960s, by 1970, the real value of U.S. aid had dropped by one-fifth, constituting less than one-third of all aid flows.[42]

Equally impressive was the shift in the origins of aid. Although the Japanese had been major borrowers of World Bank funds throughout the 1960s, by the mid-1970s, they were major providers of concessionary aid, focusing their efforts for the most part in East Asia. West Germans also rose in rank to become the third largest donor among the OECD countries. In the wake of the 1973 oil embargo, the OPEC countries also became critical players in the world economy; serving also as major lenders. By 1975, the OPEC countries had increased their aid ninefold; most of this aid was destined for the Islamic world.[43]

New donors clearly had their own priorities, which were not always consistent with U.S. goals. Less concerned than the United States about communism, many pressed for economic development over national security goals. Included, for example, were the Netherlands, the United Kingdom, and France, with France also seeking to promote its own language and culture. The Swedes, for their part, not only opposed political and strategic aid; they were also among the first to call for projects that stressed Third World self-reliance and basic human needs. Other countries, such as West Germany and Japan, had economically oriented aid programs intended to promote trade and exports.[44]

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[38] Describing his and his colleagues work at the time, Rustow notes, for example, "The central distinctive feature of our approach was that we placed economic growth and foreign aid systematically within the framework of the process of the modernization of societies as a whole." W.W. Rustow op. cit., footnote 2, pp. 43–54. See also Raymond F. Mikesell, Robert A. Kilmarx and M. Kramish, *The Economics of Foreign Aid and Self-Sustaining Development* (Boulder, CO: Westview Press, 1985), pp. 5–6.

[39] As Cingranelli notes, "Kennedy stated boldly for the first time that U.S. foreign policy should seek to affect not just the foreign policies of other nations, but their domestic affairs as well." Cingranelli, op. cit., footnote 27, p. 169.

[40] Robert E. Wood, *From Marshall Plan to Debt Crisis: Foreign Aid and Development Choices in the World Economy* (Berkeley, CA: University of California Press, 1986), p. 75.

[41] David Halloran Lunsdaine, *Moral Vision in International Politics: The Foreign Aid Regime 1949–1989* (Princeton, NJ: Princeton University Press, 1993), pp. 238–239.

[42] Browne, op. cit., footnote 20, p. 36.

[43] Ibid.

[44] Wood, op. cit., footnote 40.

BOX 2-1: The U.S. Agency for International Development (USAID)

USAID is one of several federal agencies responsible for administering the international affairs budget of the United States. Established in 1961, USAID dispenses bilateral assistance to support its four sustainable development strategies of promoting broad-based economic growth, stabilizing world population, protecting the environment, and fostering democratic principles. USAID administered about one-third of the $21.5 billion spent by the U.S. government on International Affairs in Fiscal Year 1995. The major USAID-administered programs and approximate budget figures are listed below.

	1995 Estimate	1996 Request
Development Assistance Fund	$1,319,402,000	$1,300,000,000
Development Fund for Africa	802,000,000	802,000,000
Microenterprise and Other Credit Programs	2,000,000	14,500,000
Housing Guaranty Program	27,300,000	24,000,000
International Disaster Assistance	169,998,000	200,000,000
Foreign Service Retirement and Disability	45,118,000	43,914,000
Operating Expenses	556,645,000	568,145,000
Subtotal: Development Assistance	$2,922,463,000	$2,952,559,000
Economic Support Fund	$2,450,900,000	$2,494,300,000
Assistance for Central and Eastern Europe	359,000,000	480,000,000
Assistance for the Newly Independent States	719,400,000	788,000,000
	$6,451,763,000	$6,714,859,000

Development Assistance activities are designed to promote sustainable development in some of the poorest countries in the world. The largest program in this category is the Development Assistance Fund which in FY 1995 made grants to developing country governments, nongovernmental organizations, and international agencies totaling approximately $1.3 billion. Roughly one-third of this total was aimed specifically at stabilizing world population. The Development Fund for Africa was created in FY 1988 as a single development fund for sub-Saharan Africa, thereby giving USAID greater flexibility in meeting the region's development needs. Funds for Microenterprise and Other Credit Programs are used to guarantee market rate loans for small enterprises developments which further USAID's development agenda. The Housing Guaranty Program extends guaranties to U.S. private investors who make loans to developing countries to assist them in formulating and executing sound housing and community development policies that meet the needs of lower income groups.

The $2.5 billion spent through the Economic Support Fund in FY 1995 included $220 million for countries in transition such as Nicaragua, Haiti, and Cambodia and $2.3 billion for promoting peace and economic development especially in Israel, the West Bank, Gaza, Egypt and Turkey. USAID also continued to support democratization in Central and Eastern Europe and the Newly Independent States of the Former Soviet Union begun in 1989 with passage of the Support for Eastern European Democracy Act and the Freedom Support Act.

SOURCE: Adapted from the Agency for International Development, Congressional Presentation, Fiscal Year 1996.

FIGURE 2-2: Evolution of Multinatio



SOURCE: David Halloran Lumsdaine, "Moral Vision in International Politics, The Foreign Policy Regime, 1949-1989" (Princeton, NJ: Princeton University Press),

Responsibility for foreign assistance was further diffused, as more and more aid was channeled through the many multilateral organizations that had proliferated and gained prominence throughout the 1960s (see figure 2-2). Thus, whereas in 1964, only 6 percent of U.S. aid was distributed via multinational organizations, by 1970, this figure had risen to 14 percent, and by 1975, it reached 35 percent. A parallel development occurred in other OECD countries, with multilateral aid totaling 6, 14, and 23 percent for the same years .45

One growing source of multilateral funding was the regional development banks. These banks were set up during the 1960s to increase funding to specific regions of the world. Modeled after the IBRD and IDA, they offered loans to the developing countries both on a commercial and a concessionary basis.

International politics played an important role in the regional development banks' establishment. Initially, recipient countries lobbied hard on their behalf, while the United States consistently opposed them. The United States did not want to further dilute its control over the flow of aid. Nor was it eager for new development banks to compete with private lenders.[46] But eventually, and in each case, the U.S. Government was forced to acquiesce in the face of pressing international events. Thus, the InterAmerican Development Bank was set up in 1959 to discourage Latin American radicalism; the Asian Development Bank, in 1965 to offset military activities in Vietnam; and the African Development Bank, in

45 Rustow, op. cit., footnote 2, p. 179.
46 Wood, op. cit., footnote 40.

1974 to foster better relationships with the black African states.

As a major donor, the United States was able to exercise considerable leverage.[47] Most important from a long term perspective, it steered the bank's loan policies so as to foster Western economic and political principles throughout the developing world. Moreover, when critical U.S. interests were at stake, U.S. bank officials were generally able to influence loan decisions to promote a more specific or immediate foreign policy goal.[48]

U.S. influence was less pronounced in the Development Assistance Committee (DAC) of the OECD, a second major source of multilateral assistance. Set up in 1963, the DAC aimed to coordinate the growing number of bilateral development programs that had evolved in parallel with USAID. Created at the high tide of the "development decade," the DAC was a clarion for foreign assistance. Given its own professional staff with the power to monitor, collect statistics, and set standards, the DAC strongly influenced international aid policy and distribution.[49] By setting higher and higher targets, the DAC generated greater quantities of aid. However, by focusing on the moral obligation to provide aid, the DAC failed to sufficiently debate and develop a more comprehensive and enduring foreign assistance rationale.[50]

Developing countries also came to play an increasingly important role in promoting aid, with the United Nations (U.N.) providing the major forum for articulating their needs. Unlike the multilateral developing banks—where voting is weighted—in the U.N. General Assembly all parties have an equal voice. Comprising approximately two-thirds of U.N. members in 1960, the Third World was not to be ignored. Proclaiming the 1960s as the First U.N. Development Decade, developing countries set an aid target totaling 1 percent of the combined incomes of the industrialized world. In the next four years, a number of new aid programs were introduced, and the amount of aid that was channeled through them quadrupled.[51]

The developing countries seemed to thrived in this expanded aid environment. In particular, the East Asian countries such as Taiwan, Hong Kong, Korea and Singapore took advantage of the opportunity to propel their economies beyond the stage of "take-off" for sustainable economic growth. [52] Even the poorest countries, however, appeared to do well, achieving growth rates above their norms. India, for example, experienced growth in gross domestic per capital income of 1.5 percent. Although low in comparison with many other developing countries during this era, India's growth rate in the 1970s was more than three times higher than it had been the century before.[53]

For some countries, these economic gains were illusory. When later put to the test in a contracting international economic environment, these economies could not sustain their growth. To the contrary, many governments continued to borrow to keep their growth rates high. However, such policies were ultimately self-defeating, plunging many developing countries yet deeper and deeper into debt.

For the United States, the record of this period was also mixed. The massive growth in multilateral support for foreign assistance helped to

[47] Organized along the lines of a joint stock company, the multinational banks use a system of weighted voting, which gave major donors such as the United States a predominant voice. The United States also held the positions of president of the World Bank and executive vice-president of the International Development Bank, which oversees concessionary funding. Ibid., p. 8.

[48] Jonathan E. Sanford, *Foreign Policy and Multilateral Development Banks* (Boulder CO: Westview Press, 1982), pp. 39–40.

[49] The original members included the six established donors—the United States, France, the United Kingdom, the Netherlands, Belgium, and Portugal as well as four newer donors, West Germany, Japan, Italy, and Canada. Lunsdaine, op. cit., footnote 41, p. 246.

[50] Browne, op. cit., footnote 20, p. 24.

[51] Included among these programs were the capital funded Special U.N. Fund for Economic Development (SUNFED), which when later was consolidated with EPTA became the U.N. Development Fund, The World Food Program, created by the UN Food and Agricultural Organization in 1963; the U.N. Development Organization (UNIDO) set up in 1967; and the World Employment Program, begun by the International Labor Organization (ILO) in 1969.

[52] The concept of "takeoff" was developed by W.W. Rustow as part of his model of the evolutionary process leading to nonreversible economic development. See W.W. Rustow, *The Stages of Economic Growth* (Cambridge, UK: Cambridge University Press, 1960).

[53] Krueger, op. cit., footnote 11, p. 13.

reduce the heavy financial and administrative burden that the United States assumed at the end of the Second World War. At the same time, however, the entry of new participants made it harder for the United States to use aid for its own foreign policy purposes. Eventually, this lack of control served to undermine domestic support for aid. As the decade wore on, U.S. aid representatives were increasingly chastised by Congress for failing to adequately protect U.S. interests.[54]

Disappointment and Retrenchment

The public and congressional enthusiasm that accompanied Kennedy's foreign aid initiative was short-lived. Already by 1963, funding for U.S. foreign assistance began to dwindle, and it continued on a downward slope for more than a decade (see figure 2-3).[55] Public enthusiasm for foreign assistance was also on the wane. In a poll taken in 1980, more than eighty percent of the respondents favored a cutback in all foreign aid.[56] Many factors accounted for this growing disillusionment. Included, for example, were a crisis in the world economy, which led to greater preoccupation with domestic affairs; the growing importance of private capital flows as a substitute for aid; failed expectations and a loss of confidence in aid policies; as well as emerging North-South tensions.

Living up to the expectations of the 1960s would have been difficult in any event. It proved to be impossible, however, in the radically changed international and domestic environment characterizing the 1970s and 1980s. Nothing confirmed this transformation more than the 1973 OPEC oil embargo and the rising price of oil. Prior to the first hike in oil prices, industrialized countries had a current account surplus of about 1 percent of GNP, while the developing countries had an equivalent modest deficit of 1 percent. Within a year, the situation changed radically. Industrialized countries had lost their surplus, and many developing countries had doubled their deficits.[57]

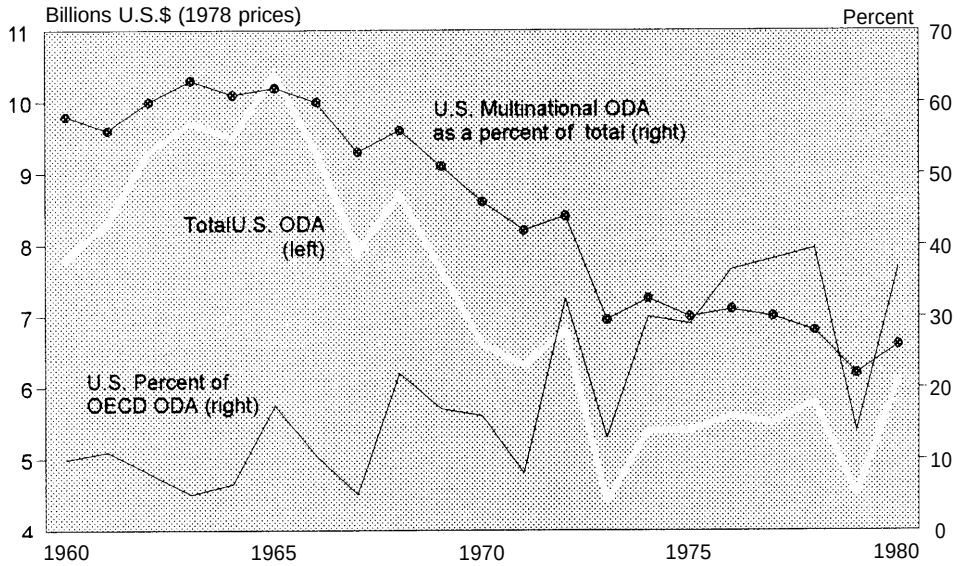
The second oil price increase, in 1979, was even more devastating, creating balance of payments problems for industrialized countries, as well. In the United States, these problems were compounded by the drain on the economy due to the protracted Vietnam War. The result was a long period of stagflation characterized by both high prices and minimal growth, leading to increased protectionism and a decline in the demand for Third World imports. Thus, the volume of world trade grew only 1.5 percent in 1980; was virtually nil in 1981; and dropped 3.2 percent in 1982. Although the volume of world trade increased in 1983 by 2 percent, its value fell proportionately.[58]

Faced with their own economic problems, industrialized countries could not meet the developing countries' growing capital needs. In the United States, for example, President Nixon called increasingly on the private sector to fill this financial gap. To this end, the Nixon Administration created the Overseas Private Investment Corporation (OPIC), which provided government insurance for private investments in developing countries (see box 2-2).

With "petrodollars to spare," Western banks eagerly took up the slack. Developing countries appeared a good investment.[59] Moreover, so long as interest rates remained fixed and inflation was on the rise, these countries could borrow without increasing their debt-service ratios. And, borrow they did. In the years between 1970 and 1980, private lending by commercial banks increased in real terms from $9 billion to $47 billion. And the proportion of total net financial

[54] Jonathan E. Sanford, op. cit., footnote 48, pp. 182–183.
[55] Krueger, op. cit., footnote 11, p. 30.
[56] Robert E. Wood, op. cit., footnote 40, p. 1.
[57] Browne, op. cit., footnote 20. p. 31.
[58] Raul L. Madrid, *Overexposed: U.S. Banks Confront the Third World Debt Crisis* (Boulder CO: Westview Press, 1992), p. 73.
[59] Gilpin, op. cit., footnote 22, p. 318 and Wood, op. cit., footnote 40, p. 243.

FIGURE 2-3: U.S. Official Development Assistance, 1960–80.



SOURCE: World Development Report 1981 (World Bank) Table 6, p, 164-165 as cited in W.W. Rostow, *Eisenhower, Kennedy, and Foreign Aid* (Austin, TX: University of Texas Press, 1985).

BOX 2-2: The Overseas Private Investment Corporation (OPIC)

Since beginning operations in 1971, OPIC has been the key U.S. government agency encouraging American private business investment in developing countries. It encourages investment by providing project financing and political risk insurance to ventures with significant equity or management participation by U.S. companies. OPIC provides these ventures with direct loans and loan guarantees that provide medium to long-term funding and look for repayment from project revenues. Political risk insurance is used by recipients to insure against expropriation of assets, currency inconvertibility, political violence and other forms of investment exposure. OPIC also supports a small number of privately managed investment funds that target emerging markets around the world and provides other investor services including seminars and conferences throughout the United States, investment missions and reverse missions.

From FY 1988 through FY 1993, OPIC provided $434,030,732 in political risk insurance and $195,650,000 in financing through direct loans and/or loan guarantees to developing countries.

SOURCE: OPIC 1994 Annual Report and "U.S. Government, Private Sector, NonProfit, and Academic Contributions to Communications Development, " Information Infrastructure Task Force, March 1994.

receipts that constituted aid fell from 60 to 30 percent in the years between 1960 and 1980.[60]

This situation was untenable over the long run, however. The onset of a worldwide recession in 1980, accompanied by a shift to floating exchange rates, reduced the demand for developing country exports, forcing them to borrow again and again to finance their current account

60 Anne 0. Krueger and Vernon W. Ruttan, in Krueger, Michalopoulos, and Ruttan op. cit., "Toward a Theory of Development Assistance," footnote 9, chap. 3, p. 37.

deficits. This time, however, worldwide interest rates were much higher, so debt service costs were no longer in their favor. The result was the debt crisis of 1982, discussed below.

With developing countries no better off than a decade earlier, many began to question the value of aid. Criticism abounded, coming from all quarters. Conservatives and radicals alike opposed the foreign aid regime not simply because it was ineffective, but rather—and much more significantly—because it was considered to be detrimental to economic development goals.[61]

Citing the long history of Western progress, conservative critics emphasized that economic development did not require economic aid. To the contrary, economic growth—as they pointed out—had occurred only in situations where markets were free and open, and where cultures were supportive of individualistic, entrepreneurial norms. Aid, they argued, could only stunt economic development. Foreign capital, when provided as aid, was likely to substitute for, rather than to encourage, domestic savings. Moreover, when distributed to those in power, aid was likely to be used to promote government controls and to perpetuate corrupt and inefficient business practices.[62]

Like the conservatives, the critics on the left also believed that the long run consequences of foreign aid were negative.[63] They argued that, if anything, aid served only to widen the gap between the rich and the poor. Rarely, if ever, had aid benefited the people most in need. Instead, it had been used primarily to bolster the positions of those in power.[64] Donors, these critics claimed, were equally at fault, aligning themselves with elites in developing countries so as to achieve their own political and economic objectives.[65] From this radical perspective, what was needed to assure that aid served the poor was nothing less than a total redistribution of political power.

This debate over the merits of aid raised fundamental questions about the nature of economic development itself. The result was a major shift in the direction of foreign assistance programs. Economic development was no longer viewed as a problem of increasing capital inputs so as to generate greater national output. Instead, it was conceived as a problem of reducing poverty and providing for peoples' basic needs.[66] Accordingly, aid programs were redesigned to focus less on infrastructure development and more on income redistribution. The oil embargo had also made people more conscious of the need to conserve natural resources. Increasingly, aid programs sought to take into account the effect of economic and population growth on environmentally sustainable development.

Reflecting this shift in priorities, the Congress passed the Foreign Assistance Act (referred to as the Basic Human Needs Mandate or New Directions) in 1973. This legislation called for a new aid strategy to help poor people in the Third World improve their food production, health care, nutrition, population planning, and educa-

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[61] Roger C. Riddell, *Foreign Aid Reconsidered*, op.cit., footnote 9; See also Paul Mosley, *Foreign Aid: Its Defense and Reform* (Lexington, KY: The University of Kentucky, 1987).

[62] Ibid.

[63] Ibid., pp. 129–156.

[64] F. M. Lappe, J. Collins, and D. Kinley, *Aid as Obstacle: Twenty Questions About Our Foreign Aid and the Hungry* (San Francisco, CA: Institute for Food and Development Policy, 1980).

[65] As described by Carty and Smith, "Underdevelopment... didn't just 'happen'—nor is it a problem solely generated within the Third World. External forces have substantially created it. In every situation of underdevelopment, there are *underdevelopers*—structures, powers, and governments which ride the backs of the southern nations and choke off their development possibilities." R. Carty and V. Smith, *Perpetuating Poverty—The Political Economy of Canadian Foreign Aid* (Toronto, Canada: Between the Lines, 1981), p. 11, as cited in Riddell, op. cit., footnote 9, p. 134.

[66] The basic needs approach was first laid out by the Director-General of the International Labor Organization (ILO), in March 1976 during a speech to the World Employment Conference. See *Employment, Growth, and Basic Needs: A One World Problem* (Geneva, Switzerland: The International Labor Office, 1976), p. 31; see also Robert L. Curry Jr., "The Basic Needs Strategy, the Congressional Mandate, and U.S. Foreign Aid Policy," *Journal of Economic Issues*, vol. 23, No. 4, 1989, pp. 1085–1096.

tion.[67] Five years later, in 1978, Congress reaffirmed that the principal purpose of U.S. bilateral aid was to support equitable growth, so that the world's impoverished people could "satisfy their basic needs and lead lives of decency, dignity, and hope."[68]

This new congressional mandate coincided with, and was reinforced by, the Carter Administration's foreign policy efforts to protect human rights and improve North/South relations. Foreign aid was central to this effort. The provision or denial of aid was often used to induce developing countries to respect human rights. Thus, notwithstanding the overall downward trend in funding, expenditures on foreign aid increased from $4 billion in 1976 to $7 billion in 1980 during President Carter's tenure.[69]

Parallel changes were also taking place in the international arena. In the 1970s, the World Bank restructured its lending programs around a three-pronged approach. First, foreign assistance was redirected to the 25 most impoverished countries.[70] Many of these—located in Africa—had previously received only a small proportion of aid. Second, funds were shifted from large scale, growth-oriented infrastructure projects to more general programs designed to meet human needs and provide purchasing power to the poor. Finally, funding was set aside for direct intervention to alleviate poverty.[71]

Although the basic needs approach helped to bring problems of poverty, rural areas, and equity to the fore, it was limited in a number of ways. One difficulty, which soon became obvious, was defining poverty and determining basic needs. Generalizing was problematic, because peoples' "needs" are highly contextual. Locating the poor and gaining the support of local elites also proved difficult.[72]

From the long-term perspective, the most serious problem was the inclination to downplay—and in some cases even denigrate—the need for economic growth.[73] Proponents argued that growth policies, which rely on "trickle-down" benefits, are unlikely to serve the poor.[74] What they failed to take into account, however, is that without growth, developing countries will not have sufficient resources to provide for basic needs. Moreover, when resources are channeled for present consumption rather than for investments for the future, later generations may be at risk.[75]

Significantly, those countries that deliberately pursued growth-oriented development policies far outperformed those that did not. Most successful in this regard were the East Asian countries—Korea, Taiwan, Singapore, and Hong Kong, which developed highly successful export-oriented growth strategies. Between 1960 and 1989, for example, these countries increased their exports from $2 billion (which constituted 5 percent of all developing country exports) to $246 billion (or 32 percent of all developing countries' exports).[76] This export growth not only served to prime the newly industrializing countries' (NICs) domestic economies; it also provided the foreign exchange necessary to survive the subsequent downturn in the global economy.[77]

The basic needs approach posed problems not only for aid recipients but for aid donors as well,

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[67] Mark F. McGuire and Vernon W. Ruttan, "Lost Directions: U.S. Foreign Assistance Policy Since New Directions," *The Journal of Developing Areas*, vol. 24, January 1990, pp. 127–180.

[68] Ibid.

[69] Rustow, op. cit., footnote 2, p. 185.

[70] Countries in poverty were designated in 1973, using criteria such as income per capita, literacy rates, manufacturing capabilities, etc. A decade later, the number of countries in this category had actually increased. Browne, op. cit., footnote 20, pp. 116–117.

[71] Ibid.

[72] Robert Ayres, *Banking on the Poor: The World Bank and World Poverty* (Cambridge, Mass. MIT Press, 1983), pp. 102–103.

[73] Sidney Dell, "Development Objectives: Basic Needs or Comprehensive Development," in Sidney Dell, International Development Policies: *Perspectives for Industrialized Countries* (Durham, NC: Duke University Press, 1991).

[74] Judith Tendler, *Rural Projects Through Urban Eyes: An Interpretation of the World Bank New Style Rural Development Projects*, World Bank, Working Paper, No. 532, 1982, p. 3.

[75] Dell, op. cit., footnote 73.

[76] Krueger, op. cit., footnote 11, p. 105.

[77] Stanley Fischer and Ishrat Husain,"Managing the Debt Crisis in the 1990s," *Finance and Development*, June 1990, p. 24.

making it hard for them to design, evaluate, and/or influence project outcomes.[78] Because aid was distributed to alleviate poverty, donors were unable to channel foreign assistance to countries that—given their policies and resources—could use it most effectively. In addition, when aid programs were oriented towards general programs rather than specific projects, donors had less control and fewer opportunities to work cooperatively with recipient countries, sharing knowledge and information in a two-way fashion.

Given its focus on poverty and program flexibility, the basic needs approach was intended to improve relations with the Third World. However, instead of ameliorating North/South tensions, foreign aid—and the related issue of the developing countries' role in the world economy—became a major source of contention. Far from being pleased with the new aid regime, developing countries complained that aid donors did not go far enough in meeting their needs.

To rectify the situation, Third World countries called for a new international economic order, which—based on a wide range of institutional reforms—would give them greater power and control over their own fates. In late 1974, these objectives were incorporated into the "U.N. Charter of Economic Rights and Duties of States," in keeping with a vote of the General Assembly, where the developing countries—known as the Group of 77—had a solid majority.[79]

Unwilling to renounce their authority and freedom of action, donor countries strongly resisted such changes.[80] While maintaining a dialogue with the Group of 77, donor countries were increasingly irritated by, and unreceptive to, their demands. This growing antagonism was only partially assuaged when the U.N. proclaimed the 1980s the "Third Development Decade."[81]

Thus, the basic needs approach also failed to alleviate political tensions between industrialized and developing countries. To the contrary, U.S. interactions with the Third World deteriorated. The "Second Development Decade," which had begun inauspiciously with the oil embargo of 1973, closed in a resounding finale with the Iranian Revolution of 1979.

This deteriorating international political situation helps account for the abrupt shift in U.S. foreign aid policy that occurred at the end of the seventies. On entering office, President Carter strongly advocated the basic needs approach. However, by the end of his term, the Carter Administration was redirecting its foreign assistance programs to U.S. security needs In 1979, the Administration's overall appropriation bill allocated $1.91 billion for security support assistance but only $1.3 billion to economic development. To facilitate this shift in focus, aid funding was increasingly drawn from the Economic Support Fund (ESF) account, which—being totally fungible—could rapidly be dispersed for any politically expedient purpose. [82]

The Reagan Administration went even further in moving away from a basic needs approach to one focusing on security-related foreign assistance. Early on, the Acting Assistant Secretary of State for African Affairs announced that foreign assistance would increasingly "emphasize areas of strategic and political priority to the U.S.," as well as rely heavily on the ESF, which "provides flexible resources necessary to carry forward our

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[78] Krueger, et al., op. cit., footnote 9.

[79] These demands were made at a special session of the U.N. General Assembly held in early 1974. At the end of the year, they were incorporated into the U.N. Charter of Economic Rights and Duties of States. They included the rights to 1) form producer associations; 2) link commodity export prices to the prices of manufacturing goods exported from the industrialized world; 3) nationalize foreign enterprises and domestic control of natural resources; and 4) establish rules and regulations for multinational corporations located within their borders. Gilpin, op.cit., footnote 22, p. 298; See also Steven Krasner, *Structural Conflict: The Third World Against Global Liberalism* (Berkeley, CA: The University of California Press, 1985).

[80] Wood, op. cit., footnote 40, p. 113.

[81] Rustow, op. cit., footnote 2. p. 230.

[82] McGuire and Ruttan, op. cit., footnote 67, p. 128.

U.S. policies in nations affected by rapidly changing economic and security problems."[83]

The ultimate—and perhaps inevitable—breakdown in the international aid regime did not occur, however, until August 1982, when the Mexican government announced that, without assistance, it could not service its foreign debt. Within two years, no fewer than 42 additional countries—with outstanding foreign debts totaling $27 billion—followed suit.[84] The Reagan Administration had little choice but to intervene. American banks held a major portion of the less developed countries (LDC) debt, so their very existence was at stake. The claims held by the nine largest U.S. banks against Argentina, Brazil, and Mexico constituted more than 135 percent of their total capital.[85]

From Debt Crisis to Structural Adjustment

The LDC debt crisis not only marked the end of the old aid regime. Equally important, its mode of resolution became the model, and modus operandi, for the aid regime to follow. Foreign aid was henceforth no longer viewed as the key to economic growth. Much more critical was the role that developing countries could themselves play in restructuring their economies in accordance with market principles. Most policymakers agreed that, in the post-debt-crisis environment, aid might best be used not to promote growth per se, but rather to induce structural economic adjustments to foster growth and facilitate the developing countries' integration into the global economy.

The debt crisis served to winnow Third World winners from losers. The few countries that pursued growth strategies based on austerity and export promotion survived the upheavals of the seventies with their economies intact. On the other hand, most developing countries borrowed heavily throughout this period. And instead of investing in development projects, they used these funds to cover growing trade imbalances and debt servicing requirements. Their growth rates fell as a result, compounding their liquidity problems and further stifling their development.[86]

Given such fundamentally different economic outcomes, private investors and foreign aid providers alike began to examine how policies in recipient countries might affect economic development prospects. Comparing experiences, they concluded that developing countries' problems stemmed from their own economic policies, which distorted market signals, misallocated resources, and discouraged efficient production and investment. For growth to occur, the developing countries—they contended—had to restructure their economies according to free market principles.[87] Foreign banks holding developing countries' loans agreed with this assessment, which served to justify their firm stance in setting up rescheduling terms.[88]

Given no alternative sources of funding and little bargaining power, debtor countries rapidly acceded to the banks' seemingly harsh demands. In exchange for rescheduling of their debts, developing countries agreed to reduce domestic demand for both imports and exports by curtailing budget deficits, reducing real wages, and devaluating their currencies.[89]

The multinational banks played a major role in the rescheduling negotiations. Public lenders increased their disbursements to the 17 most

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[83] As cited in Robert L. Curry, Jr., footnote 66, p. 1092.

[84] Raul L. Madrid, op. cit., footnote 58.

[85] Benjamin J. Cohen, "What Ever Happened to the LDC Debt Crisis?" *Challenge*, May/June 1991, p. 48. Argentina, Brazil, and Mexico alone owed about $260 billion, which constituted 40 percent of the total Latin American debt.

[86] Madrid, op. cit., footnote 58, p. 73.

[87] For one discussion, see Anne O. Krueger, *Economic Policy Reform in Developing Countries* (Cambridge, MA: Blackwell, 1992).

[88] The developing countries were not alone, however, in failing to foresee the dire consequences of such heavy borrowing. Despite numerous warning signals about the deteriorated state of the developing economies, U.S. banks assiduously cultivated relationships with Third World political and business leaders, hoping to outbid one another for these highly lucrative loans. Moreover, U.S. and other foreign banks accumulated these mounting credit obligations with the blessings of the governments of the industrialized countries. Madrid, footnote 58, op. cit; and Dell, op. cit., footnote 73, p. 136.

[89] Dell, op. cit., footnote 73, p. 144.

debt-troubled countries from $3.7 billion in 1981 to $5.5 billion in 1983. By 1985, funding totaled $6.3 billion.[90] Without this increased support, debtor countries would have been unable to refinance their loans. The multilateral banks also legitimized the rescheduling process. Banks generally looked to the IMF to approve a debtor country's austerity program. In fact, in some cases, they refused to enter into discussions with debtor countries until the multinational lenders had given their approval.[91]

These debt scheduling agreements proved, however, to be unenforceable. Given the imposed austerity programs, Third World economies went into reverse. Thus, for example, the GDP of many Latin American countries fell during the period from 1981 to 1985, as did income and per capita consumption.[92] Low growth rates meant, moreover, that debtor countries were once again in arrears. By the late 1980s, some countries stopped making their interest payments, while others insisted on gaining greater bank concessions.[93]

Acknowledging the gravity of the situation, the U.S. government sought to reduce the developing countries' debt burden. In October 1985, Secretary of the Treasury James Baker announced a plan (subsequently referred to as the Baker Plan) that called for a more broadly based and equal sharing of the debt burden. Although far more generous than the previous commercial bank agreements, the Baker Plan entailed the same quid pro quo—additional funding in exchange for trade liberalization, privatization, and greater market reform.[94]

While moving in the right direction, the Baker Plan did not go far enough. Instead of improving, developing country economies either stagnated or experienced decline.[95] Between 1981 and 1987, for example, the real gross domestic product (GDP) of the most indebted countries was less than the average growth rate of the previous decade, and in 1987 their per capita GDP fell to almost 6 percent below the 1980 level.[96] Declining growth was, moreover, accompanied by declining gross investment. As commercial banks became more cautious in their lending policies, and domestic investors increasingly hoarded financial assets abroad, gross capital formation in the most heavily indebted countries dropped from 24 to 17 percent in the period between 1981 and 1987.[97]

A new approach was clearly in order. Thus, in March 1987, Treasury Secretary Nicholas Brady proposed a new plan—the Brady Plan, which provided permanent debt relief and debt service reduction in exchange for greater economic reform.[98] Being market driven, the Brady Plan gave commercial banks a chance to exchange

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[90] Ibid.

[91] Ibid. Equally critical for debt rescheduling was the continued export credits and development grants provided by the industrialized countries to the Third World. The Paris Club Creditors—as the participating countries were called—also provided debt service relief by rescheduling payments on their previous medium and long term credits to the developing countries. In contrast to the commercial banks, the Paris Club creditors were at times also willing to reschedule interest payments.

[92] Michael P. Dooley, *A Retrospective on the Debt Crisis*, Working Paper No. 4963 (Cambridge, MA: National Bureau of Economic Research, 1994), pp. 23–24.

[93] The debtor countries attributed the stagnation of their economies to the austerity programs prescribed by the IMF, while the banks claimed that the developing countries had not extended their reforms far enough to reap the benefits. By 1985, growing discontent threatened to undermine political stability in many Third World countries.

[94] In accordance with the plan, commercial banks would make $20 billion available to the poorest 15 debtor countries within the subsequent three years, during which time multilateral banks would provide an additional $9 billion. For their part, the creditor nations would stimulate their economies and reduce their barriers to Third World imports.

[95] John Endowed, "The World Bank's Response to the Developing Country Debt Crisis," *Contemporary Policy Issues*, vol. 7, April 1989, p. 57.

[96] Norman S. Fieleke, "Economic Adjustment in Heavily Indebted Developing Countries," *Contemporary Policy Issues*, April 1990, p. 19.

[97] Ibid. See also John Clark, "Debt Reduction and Market Reentry Under the Brady Plan," *Federal Reserve Bank of New York Quarterly Review*, winter, 1993/94, p. 39.

[98] Moreover, in contrast with previous plans, which pitted debtor and creditors against one another, the Brady plan was intended to foster cooperation. Offering a menu of options, the plan was also flexible enough to allow for diverse situations in debtor nations.

their developing country loans for government issued "Brady bonds."[99]

Once again, the multinational lending institutions reinforced the notion of a quid pro quo, making aid contingent on major economic reforms. The IMF and the World Bank not only made reform a condition of lending, they also instituted special types of loans and arrangements—such as the structural adjustment loan (SAL)—to assist developing countries in carrying out the process.[100] Working together, the World Bank and the IMF advised developing countries and designed comprehensive economic reform packages for them.[101]

Many Third World countries were quick to embrace the concept of structural reforms.[102] Faced with dismal growth rates, continual debt, and the failure of state-directed development programs, they required a new development model. Thus, one by one, developing countries renounced the state-directed, import substitution growth strategies—so tenaciously pursued since the end of World War II—in favor of market reforms and export driven growth.[103] Although there were no pat formulas, most programs incorporated four basic elements—stabilization, liberalization, deregulation, and privatization.[104] Together, these measures were intended to create a market environment conducive to growth (see box 2-3).

Despite their popularity, economic reform programs have not improved the situation in many developing countries. Despite a few major success stories, overall results have been disappointing, especially in low income countries.[105] As can be seen in table 2-2, it is difficult to distinguish between the performance of those countries undertaking reforms and those that did not. Of the 55 developing countries that pursued such programs in the period between 1980 and 1988, only seven benefited across the board from greater stabilization, the restoration of growth, and a reduction in poverty. Twenty-seven of the 55 countries experienced negative growth in per capita income, while another 13 failed to reduce their external debt to a sustainable level.

Convinced of the general need for reform, economic development experts have studied and compared these cases in an effort to identify the factors that account for success. To date, most

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[99] These bonds were lower in value and had a longer term of maturity, so their purchase entailed a partial write-off of the banks' claims. Many banks were willing to accept this loss, however, because the Brady bonds were backed by treasury securities as collateral. Debtor countries, for their part, benefited from lower principals and better terms. To participate in the plan, the developing countries had to purchase treasury securities as collateral against the principal and interest on a portion of their debt, as well as adopt even greater economic reforms.

[100] See Azizur Rahman Khan, *Structural Adjustment and Income Distribution: Issues and Experience* (Geneva, Switzerland, International Labor Office, 1993), p. 33.

[101] For a discussion of the need for structural reforms, see Anne O. Krueger, "Lessons From Developing Countries About Economic Policy," *The American Economist*, vol. 38, spring 1994; For a summary and discussion of the empirical and theoretical literature, see Dani Rodrick, *Trade and Industrial Reform in Developing Countries: A Review of Recent Theory and Evidence* (Cambridge, MA: National Bureau of Economic Research, Inc. 1993).

[102] G. John Ikenberry, "The International Spread of Privatization Policies: Inducements, Learning and 'Policy Bandwagoning,'" in Ezra N. Suleiman and John Waterbury (eds.), *The Political Economy of Public Sector Reform and Privatization* (Boulder, CO: Westview Press, 1990), chap. 4.

[103] Not surprisingly, therefore, between 1980 and 1991, 76 Third World countries received World Bank SALs. And by 1991, close to half of these countries had already carried out the reforms associated with more than one SAL agreement, while 19 had implemented five or more such agreements. Kahn, op. cit., footnote 100, p. 33.

[104] Lawrence H. Summers and L.H. Pritchett, "The Structural Adjustment Debate," *Economic Development: Recent Lessons*, AEP Papers and Proceeding, May 1993, pp. 383-389. See also Ulrich Hiemenz and Norbert Funke, "The Experience of Developing Countries With Macroeconomic Stabilization and Structural Adjustment, " in Chung H. Lee and Helmut Reisen (eds.), *From Reform to Growth: China and Other Countries in Transition in Asia and Central and Eastern Europe* (Paris, France: OECD, 1994), p. 79.

[105] According to one analysis, growth in middle income countries increased from 2.1 percent to 4.8 percent per year in the period between 1981 to 1990, while in low income countries it only increased from 1.2 percent to 3.6 percent. During the same time, annual growth rates for exports increased in middle income countries from 26 to 34 percent, but increased by only one percentage point in poor countries, from 22 to 23 percent. Kahn, op. cit., footnote 100.

BOX 2-3: Economic Reform Measures

Stabilization programs were designed to bring inflation under control by contracting the economy.[1] A stable currency is required to encourage savings and investment, and to allow the market to provide accurate information. Stabilization can be brought about by devaluating exchange rates, reducing current account and fiscal deficits, and by tightening the money supply. Although necessary for the effective functioning of the economy, these types of measures can dampen economic activity. Thus, they work best when counterbalanced by structural adjustment efforts that are designed to foster growth.

Structural adjustment measures—such as trade liberalization, deregulation, and privatization—shift economic activities from the public to the private sector.[2] They can generate growth by increasing the productivity of existing resources and by channeling them into more efficient usage. Trade liberalization, for example, is designed to heighten domestic competition and to create greater incentives for governments and firms to allocate national resources on a more efficient and global basis.[3] Similarly, deregulation and privatization measures are intended to enhance efficiency by reducing unproductive government rent seeking, improving the productivity of public investment, freeing up credit and inducing savings, and eliminating price distortions. If designed and timed correctly, structural adjustment measures can help to offset some of the negative growth impacts associated with stabilization.

[1] See, for a discussion, Sebastian Edwards, "The Political Economy of Inflation and Stabilization in Developing Countries," *Economic Development and Cultural Change*, 1994, pp. 235–266.

[2] Ira W. Liberman, "Privatization: The Theme of the 1990s: An Overview," *The Columbia Journal of World Business*, spring 1993, p. 11

[3] See, for a discussion, Jim Love, "Engines of Growth—The Export and Government Sectors," *World Economy*, vol. 17, March 1994, pp. 203–218.

SOURCE: Office of Technology Assessment, 1995.

agree that constancy and commitment to reform are the key.[106] There is, however, considerable disagreement about how best to develop and sustain this commitment. At issue is the timing and sequencing of events.[107]

Pointing to successful development strategies pursued by many Asian countries, some believe it best to introduce reforms gradually and in a certain sequence, starting with microeconomic structural reforms, followed by stabilization and trade liberalization.[108] Citing the case of China, they claim that structural reforms generate growth, new economic opportunities, and new winners with a stake in maintaining reform. If such benefits are sufficiently widespread, they argue, early structural reforms can legitimate a government's efforts and help to develop a broader base of support for them.[109]

Gradualists also stress the need to begin by privatizing and introducing competition into sectors—such as agriculture and consumer goods—that do not compete with state owned enterprises (SOEs). As productivity increases in sectors such as agriculture, they argue, private investment and new jobs will gradually emerge at the fringe of

[106] Ulrich Heimenz and Norbert Funke, "The Experience of Developing Countries With Macroeconomic Stabilization and Structural Adjustment," in OECD, *From Reform to Growth*, op. cit., footnote 104, p. 79. See also Summers and Pritchett, op. cit., footnote 104.

[107] R. McKinnon, *The Order of Economic Liberalization: Financial Control in the Transition to a Market Economy* (Baltimore, MD: Johns Hopkins Press, 1991); see also Heimenz and Funke, op. cit., footnote 106, pp. 79–89.

[108] Barry Naughton, "Reforming a Planned Economy: Is China Unique?" in OECD, *From Reform to Growth*, op. cit., footnote, 104, pp. 49–71; see also Pradumna B. Rana and Wilhelmina Paz, "Economies in Transition," in OECD, op. cit., footnote 104.

[109] Naughten, op.cit. footnote 108. For a discussion of the importance of legitimacy in maintaining regimes, see Juan J. Linz and Alfred Stephan (eds.), *The Breakdown of Democratic Regimes* (Baltimore, MD: Johns Hopkins University Press, 1978).

TABLE 2-2: Relative Performance of Adjusting and Nonadjusting Countries

Indicator	Adjusting countries[1]	Nonadjusting countries[2]
1. Growth in per capita GDP between 1980 & 1989	27 of the 55 countries had negative rates of growth.	16 of the 31 countries had negative rates of growth.
2. Per capita private consumption	The rank in terms of growth rate of per capita private consumption improved slightly between 1971–79 and 1980–87 (for 25 intensely adjusting (IA) countries the rank improved from 36 to 37). For 24 IA countries per capita private consumption increased in 1980 PPP$ by 8.2% between 1970–79 and 1980–87.	The average rank in terms of growth in per capita private consumption declined slightly between 1971–79 and 1980-87. For 27 countries per capita private consumption increased in 1980 PPP$ by 19.0% between 1970–79 and 1980–87.
3. Public expenditure in social sectors	Sectoral expenditure as % of total public expenditure in 11 IA countries: Year Educ. Health Total (social sectors) 1980 14.8 6.6 36.2 1986 12.0 5.5 32.7 Per capita expenditure on education, health and social sectors in 1980 PPP$ increased from 225.70 in 1980 to 227.30 in 1986.	Sectoral expenditure as % of total public expenditure in 12 countries: Year Educ. Health Total (social sectors) 1980 10.0 4.5 25.7 1986 12.1 4.7 28.6 Per capita expenditure on education, health and social sectors in 1980 PPP$ increased from 124.70 in 1980 to 188.90 in 1986 in 12 countries.
4. Infant mortality rate	In 23 IA countries, the rate of decline during 1977–82 was 12.7% and during 1982–87 was 12.6%.	In 29 countries, the rate of decline during 1977–82 was 13.0% and during 1982–87 was 11.2%.
5. Average undernutrition rate	For 24 IA countries: 7.81% in 1980 & 8.44% in 1986.	For 32 countries: -2.54% in 1980 and 4.31% in 1986.
6. Primary school enrollment rate	For 25 IA countries: 94.2% in 1980 & 90.1% in 1985.	For 33 countries: 86.0% in 1980 and 91.1% in 1985.

1The adjusting countries are (intensely adjusting countries are in italics): Burkina Faso, Burundi, *Cote d'Ivoire*, Central African Republic, Chad, Congo, Gabon, Gambia, *Ghana*, Guinea, Guinea-Bissau, *Kenya, Madagascar, Malawi*, Mali, *Mauritania, Mauritius*, Niger, *Nigeria, Senegal,* Sierra Leone, Somalia, Sudan, *The United Republic of Tanzania*, *Togo,* Uganda, Zaire, *Zambia*, Zimbabwe, Bangladesh, China, Indonesia, *Republic of Korea*, Nepal, *Pakistan, Philippines, Thailand, Morocco*, Tunisia, *Turkey*, Hungary, Yugoslavia, Argentina, *Bolivia, Brazil, Chile, Colombia, Costa Rica*, Ecuador, Guyana, Honduras, *Jamaica, Mexico*, Panama and Uruguay. For most indicators, information is limited to a subset of intensely adjusting countries.

[2]The nonadjusting countries are: Benin, Botswana, Cameroon, Ethiopia, Lesotho, Liberia, Mozambique, Rwanda, Myanmar, India, Malaysia, Papua New Guinea, Sri Lanka, Algeria, Egypt, Jordan, Oman, Syrian Arab Republic, Yemen AR, Yemen PDR, Poland, Portugal, Dominican Republic, El Salvador, Guatemala, Haiti, Nicaragua, Paraguay, Peru, Trinidad and Tobago, and Venezuela. For most indicators, information is limited to a subset of countries. For items 5 and 6 the number of countries exceeds the basic set of 31.

SOURCE: For items 2–6, Kakwani et al., 1990. Item 1 calculated from World Bank 1991C. As indicated in "Structural Adjustment and Income Distribution Issues and Experience," Azizur Rahman Khan, International Labor Office, Geneva, 1993, p. 36.

the state-planned economy, which will generate incentives for SOEs to be more competitive. On the other hand, if SOEs are suddenly faced with competition, they will probably fail, resulting in overwhelming fiscal and unemployment problems that will undermine political support for reform. It is precisely because of the possibility of such a disaster that developing country leaders waver so in their commitment to structural adjustment.[110]

Other analysts recommend a "big bang" approach to reform.[111] They point out that Eastern European countries such as Poland and the Czech Republic, which undertook reforms on all fronts and in one stroke, outperformed those that pursued a gradualist approach.[112] Big-bang advocates claim that partial reforms signal a lack of commitment, which is especially damaging in former communist countries where—given an institutional vacuum—perverse incentives tend to thrive. As in Russia, tentative reforms, they say, will likely give rise to both insufficient benefits and inadequate readjustment, resulting in political backlash.[113] Employing the big-bang rhetoric, the Russian government privatized state-owned enterprises in 1992, but balked when it came time to institute trade liberalization and stabilization measures. [114]

Diverse crosscultural experiences suggest there is no single recipe for success. In most cases, structural reform policies must be crafted to fit the situations at hand.[115] Rarely, if ever, do existing conditions adequately match the assumptions posited by economic theory.[116] And in some countries, there may be little room for choice, given prevailing social and economic conditions. Although gradualism may succeed in countries that have a strong and stable—albeit not necessarily democratic—institutional base, it may fail in cases, such as those in Eastern Europe, parts of Latin America, and Africa, where there is a lack not only of market institutions but also of strong civic traditions.[117] In such environments, successful programs will require a broader, multifaceted approach that addresses institutional as well as economic needs.

Need for a More Integrated and Multifaceted Approach to Development

Difficulty in explaining the variable outcomes associated with economic reforms across countries and cultures signals the need for a broader approach to economic development, which takes political and cultural factors into account.[118] Economic analysis is necessary to understand

[110] Ibid.

[111] Jeffrey Sachs and Wing Thye Woo, "Understanding the Reform Experiences of China, Eastern Europe and Russia," in OECD, *From Reform to Growth*, op. cit., footnote 104, pp. 23–48; See also Ronald I. McKinnon, *Rapid Liberalization in Socialist Economies: Financial Policies in China and Russia Compared* (San Francisco, CA: International Center for Economic Growth, 1994); D. Papageorgiou, M. Michaely, and A. M. Choski (eds.), *Liberalizing Foreign Trade* (Oxford, UK: Blackwell, 1991); and Paul Collier and Jan Willem Gunning, "Aid and Exchange Rate Adjustment in African Trade Liberalization," *Economic Journal*, vol. 102, No. 413, July 1992.

[112] The Czech and the Slovak Republics, for example, both experienced major unemployment crises in the post-reform period. Beginning in 1991, unemployment in the Slovak Republic rose to 12.7 percent in 1992. See John Ham, Jan Svejnar, and Katherine Terrel, "The Emergence of Unemployment in the Czech and Slovak Republics," *Comparative Economic Studies*, vol. 35, No. 4, winter, 1993, pp. 121-133; See also Saul Estrin, "Industrial Restructuring and Microeconomic Adjustment in Poland: A Cross-Sectoral Approach, *Comparative Economic Studies*, vol. 35, No. 4, winter 1993, pp. 1–19.

[113] Grant Kirkpatrick, "Transition Experiences Compared: Lessons from Central and Eastern Europe's Reform," in OECD, *From Reform to Growth*, op. cit., footnote 104, pp. 95–119; and Sachs and Woo, op. cit., footnote 111.

[114] Sachs and Woo, footnote 111, p. 27.

[115] Comparative analysis now shows that the *stage* of development at which policies are introduced is perhaps the most important variable determining success. See, for a comprehensive discussion, Zehra F. Arat, *Democracy and Human Rights in Developing Countries* (Boulder, CO: Lynne Riennes Publishers, 1991).

[116] As Kahn points out, "Growth prospects may actually be harmed by any number of inflexibilities so characteristic of the developing countries," Kahn, op. cit., footnote 100, pp. 12–13.

[117] For a comparison of the Eastern European and Latin American contexts, see Tina Rosenberg, "Overcoming the Legacies of Dictatorship," *Foreign Affairs*, vol. 74, No. 3, pp. 134–152.

[118] Arat, op. cit., footnote 115.

development failures and to design better ways to improve Third World economic prospects. But economic analysis, by itself, is not enough. Failed efforts result not only from the particular sequence in which reforms are introduced but also from the fragile political and institutional environment in which they are implemented and consolidated.[119] If future foreign assistance programs are to promote sustainable economic development, which supports democracy and political stability, social and political factors must be better incorporated into their design.

Because structural adjustment measures emphasize the shift of economic activity from the public to the private sector, the government's critical role in reform efforts has often been downplayed.[120] However, market reform does not—as might be implied—entail the "withering away of the state." To the contrary, the state—at least in the initial phases of reform—must play a central role both in creating and in preserving economic markets. At the most fundamental level, for example, it is government that determines the norms governing market behavior. Governments also define economic actors—proprietors, workers, and corporations—by establishing and enforcing their rights and obligations, the rules by which they interact, and the means they use for exchange. These decisions are of major importance, determining both economic opportunities and the performance of the economy as a whole.[121]

The challenges facing governments shifting from a command to a market economy are monumental. Political leaders must not only design and implement a new legal and institutional framework to govern emerging markets; they must also—and at the same time—generate a political consensus to support these arrangements as well as consolidate their own political power. The time frame for achieving success is, moreover, highly compressed.[122]

The overwhelming problems encountered in executing economic reforms raise fundamental questions about today's operating model of economic development, central to which is the assumption that economic freedoms and political freedoms go hand in hand.[123] Experience with economic reforms suggests, however, that this is not necessarily the case. Democratic governments, for example, appear to be somewhat disadvantaged in carrying out market reforms.[124] Depending for their existence on popular support, democratic leaders are more vulnerable than their authoritarian counterparts to ideologi-

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[119] Jose Maria Maravall, "The Myth of Authoritarian Advantage," *Journal of Democracy, Economic Reform and Democracy*, Special Issue, October 1994, pp. 22–23. See also Stephan Haggard and Robert R. Kaufman, "The Challenges of Consolidation," in *Journal of Democracy*, Ibid., pp. 5–6.

[120] See Jan Kregel, Egon Matzner, and Gernot Grabher, *The Market Shock* (Vienna, Austria: Austrian Academy of Sciences, Research Unit for Socioeconomics, 1992).

[121] See Douglas C. North, *Institutions, Institutional Change, and Economic Performance* (Cambridge, UK: Cambridge University Press 1990); see also Joseph Stiglitz, "Social Absorption Capability and Innovation," CEPR Publication No. 292, *Center for Economic Policy Research*, Stanford CA, November 1991.

[122] See, for discussion of the importance of sequence, E.A. Nordlinger, "Political Development, Time, Sequence and Rates of Change," in Jason L. Finkle and Robert W. Gable (eds.), *Political Development and Social Theory* (New York, NY: John Wiley and Sons, 1976), pp. 455–471; Leonard Binder, James S. Coleman, Joseph LaPolembara, Lucien Pye, Sydney Verba and Myron Weiner (eds.), *Crisis and Sequence in Political Development* (Princeton, NJ: Princeton University Press, 1971); and Dankwart A. Rustow, "Transitioning to Democracy: A Global Revolution?" *Foreign Affairs*, vol. 69, No. 4, fall 1990, pp. 75–91.

[123] This assumption received support from the crossnational quantitative research program led by sociologist Seymour Martin Lipset in the late 1950s and early 1960s. Using a wide range of indicators, these researchers found a positive correlation between the level of economic development and democracy. Subsequent analyses have shown the relationship between democracy and economic development to be much more complex. As described by Arat, "Increasing levels of economic development do not necessarily lead to higher levels of democracy, even for the less developed countries....Developing countries do not display a linear relationship but instead more complex patterns or no relationships at all. In fact, in most of these countries, especially the ones located in the middle of the development axis, there is a higher level of instability—a continuous back and forth shift. See Arat, op. cit., footnote 115, p. 49. See also Evelyn Huber, Dietrich Rueschemeyer, and John D. Stephens, "The Impact of Economic Development on Democracy," *Journal of Economic Perspectives*, vol. 7, No. 3, summer 1993, pp. 71–85.

[124] Adam Przeworski and Fernando L. Inougi, "Political Regimes and Economic Growth," in *Journal of Economic Perspectives*, vol. 7, No. 3, summer 1993, pp. 51–69.

cal contradictions, institutional failures, and lobbying by special interests. When democratic governments fail in their reform efforts, public support for democratic values, as well for the prevailing government, is jeopardized.

Political pressures to dilute and delay reform are likely to be particularly greater early on when costs are already apparent but benefits are still elusive. It is precisely at this point, however, that political leaders must rise above the immediate crisis to undertake the kinds of long-term legal and institutional changes that serve universal rather than particularistic goals. Since democratic politicians are periodically held accountable to the electorate, the time they have to forge such a consensus is very short. [125]

Privatization, deregulation, and liberalization programs may also be problematic for democratic regimes if they are carried to extremes, making it impossible for governments to generate sufficient resources to carry out their programs. Such was, in fact, the case in Latin America, where trade liberalization during the 1980s led to a rapid decline in state revenues.[126] Faced with major fiscal problems, Latin American governments were forced to cut back on public expenditures, causing the deterioration of infrastructure and a decline of many services. Public discontent mounted as a result, giving rise to widespread political instability.

If overly stringent, economic reforms may also inhibit adequate investments in social policies, which are necessary to provide some buffer to groups bearing an inordinate burden due to reforms. Trading off social goals—such as equity—has proven at best unnecessary and at worst self-defeating.[127] As experience in Asia and Southern Europe makes clear, when governments have carried out social programs in conjunction with economic reforms, the results have been very successful indeed. In contrast, if governments fail to take social justice into account, interest groups often pit themselves against one another, thereby undoing the very basis for political consensus.[128]

Acknowledging the political constraints that many developing countries face in executing economic reforms, foreign assistance organizations have designed new programs to help political leaders improve their governing capacity. The World Bank, for instance, had added the notion of "good governance" to its development repertoire.[129] Good governance, the World Bank argues, is a prerequisite for successful reform. Recognizing that many political leaders lack the experience and skill required to carry out such reforms, the Bank has initiated assistance programs to help them build up their governments' administrative and legal capacities. [130]

While these types of government-oriented assistance programs address some of the formal legal and administrative problems associated with carrying out structural economic reforms, they are inadequate for dealing with the rampant problems of political disorder and social upheaval to be found in many developing coun-

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[125] Stephan Haggard and Robert R. Kaufman, op. cit., footnote 119, pp. 5–6.; Joan M. Nelson, "Linkages Between Politics and Economics," in *Journal of Democracy*, op. cit., footnote 119, p. 54; and Jose Maria Maravall, "The Myth of Authoritarian Advantage," in *Journal of Democracy*, op. cit., footnote 119, p. 17–31.

[126] Moses Naim, "Latin America: Second Stage of Reform," in *Journal of Democracy*, op. cit., footnote 119, pp. 32–48.

[127] As Haggard and Kaufman note, "When citizens believe that the costs of reform are distributed fairly, economic reforms are more likely to succeed and democratic regimes are more likely to survive." Stephen Haggard and Robert Kaufman, op. cit., footnote 119, p. 12.

[128] Ibid., and Naim, op. cit., footnote 126, pp. 32–48.

[129] The World Bank, *Governance and Development* (Washington DC: The World Bank, 1992). It should be noted that the World Bank's mandate as laid out in its Articles of Agreement limits its ability to become involved in political issues per se. Thus, for example, it cannot interfere in the partisan politics of a member. Nor can it use its lending policies to influence the political situation in a recipient country.

[130] Good governance, according to the World Bank, can be measured by the degree to which developing countries are able to establish clear boundaries between the public and private spheres, minimize government rules and regulations, and institute economic incentives and a framework of law and governance that is transparent, predictable, and conducive to economic growth.

tries today.[131] Nor will such programs necessarily serve democratic goals.[132] As history makes all too clear, efficient government administration is no guarantee against autocratic or totalitarian governments; to the contrary, it is typically required to sustain them.

For both democracy and free markets to thrive, what is required is not simply the reemergence of strong, competent states but rather the redefinition and balancing of their roles and relationship with respect to both the marketplace and society at large. As a growing body of evidence makes clear, social and cultural institutions that foster trust and cooperation constitute a form of "social capital" that supports both free markets and democracy, and at the same time serves to better balance the relationship between them (see box 2-4).[133]

Most developing countries have very little of this social capital on which to build either efficient markets or sustainable democracies. To the contrary, the political culture in many of these countries fosters distrust and alienation. Based on authority and dependency, interpersonal relations are characterized not by mutual respect and reciprocity, but rather by distrust and alienation.[134]

If developing countries are to extricate themselves from the vicious circle that leads to political, economic and environmental decay, they must begin by making much greater investments in the development of social capital. Building trust, however, represents a problem of collective action—the classic case of the "prisoner's dilemma." Living in a society that is devoid of trust and goodwill, people are unlikely to act in mutually beneficial ways, even when it serves their own best interest. Each person fears that, if he or she is the first to act honestly, others will surely take advantage.

Broadbased foreign assistance programs can foster the development of trust, thereby providing greater basis for cooperation. Once started, cooperation tends to be self-sustaining, so investment in cooperative behavior can have a high payoff.[135] Over time, it can generate a wealth of social capital, which can be drawn on in future times of trial.

Comprehensive, multifaceted aid programs are also necessary to balance multiple foreign assistance goals, directing policymakers to focus on the development of mutually reinforcing policy criteria. Efforts to promote "sustainability" provide an example of one such approach. [136] Given a growing awareness of the potential negative impacts that economic growth might have on the global environment, academics, policymakers, nongovernmental organizations, and businesses alike have worked since the Rio Declaration of 1992 to define and operationalize the goal of "sustainability," so that it might be better

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[131] See, for one critical view of the Banks Governance Program, Mick Moore, "Declining To Learn From the East? The World Bank on 'Governance and Development.'" *IDA Bulletin*, vol. 24, No. 1, 1993, pp. 39–50. See also Carol Lancaster, "Governance and Development: The Views From Washington," *IDA Bulletin*, vol. 24, No. 1, 1993.

[132] As described by Naim with reference to Latin America, "Paradoxically, the high interventionist doctrines that gave the state a virtual monopoly over a vast array of activities greatly contributed to its decline. Even while the state was stretched far beyond its capacities, its economic centrality and political voraciousness hindered the emergence and development of spontaneous forms of social organization (clubs, nongovernmental organizations, voluntary organizations, civic forums, and so on) that constitute the backbone of what Robert Putnam calls "social capital." Without patterns of social cooperation based on tolerance, trust, and widespread norms of active citizen participation, the modicum of political stability required for the effective operation of public bureaucracies is periodically lost." Naim, op. cit., footnote 126, p. 42.

[133] See, in particular, Robert Putnam, *Making Democracy Work* (Princeton, NJ: Princeton University Press, 1993); and also Fred Block, *Postindustrial Possibilities: A Critique of Economic Discourse* (Berkeley, CA: University of California Press, 1990), pp. 41–42.

[134] Putnam, op. cit., footnote 133, p. 88.

[135] Robert Axelrod, *The Evolution of Cooperation* (New York, NY: Basic Books, 1984).

[136] The pursuit of "sustainability," has been inspired by findings from the World Commission on Environment and Development (the Brundtdland Commission), the 1992 U.N. Conference on Environment and Development, and a host of reports emanating from such bodies as the World Bank, the Organisation for Economic Cooperation and Development (OECD), and the Business Council for Sustainable Development, which warn that a continuation of current patterns of economic growth could result in levels of environmental degradation severe enough to jeopardize the ability of future generations to meet basic needs. Global environmental problems, including loss of biodiversity, climate change, and stratospheric ozone depletion, have become increasingly of concern.

BOX 2-4: The Role of Social Capital in Supporting Free Markets and Democratic Politics

Cooperative social relations and interactions can make markets more efficient and political interactions more effective. For example, all market activities are based on some form of cooperative human interaction, which is sustained by social networks. Well established social networks help to reduce the costs of market transactions because the participants need to acquire less information to do business.[1] If buyers and sellers are well known to each other, their shared expectations and mutual trust allow them to come to terms without having to haggle over prices. Similarly, given the existence of social sanctions, they do not need to expend energy making sure that bargains are kept. By reducing these kinds of "transaction costs," social networks help markets operate more effectively. To the extent that this is the case, there is less need for government to intervene with rules and regulations. Cooperative behavior similarly reinforces democratic values and participation. Over time positive social interactions give rise to societies based on trust and civic norms.[2] In a civic culture, people interact with each other as equals and according to cooperative and reciprocal norms.[3] When people support one another voluntarily, there is similarly less need for government in private life.

[1] See Douglas C. North, *Institutions, Institutional Change, and Economic Performance* (Cambridge, UK: Cambridge University Press 1990).

[2] See, for instance, Gabriel A. Almond and Sidney Verba, *The Civic Culture: Political Attitudes and Democracy in Five Nations* (Princeton, NJ: Princeton University Press, 1963). See also Robert N. Bellah, Richard Madsen, William M. Sullivan, Ann Swidler, and Stephen M. Tipton, *Habits of the Heart: Individualism and Commitment in American Life* (New York, NY: Harper and Row, 1986)

[3] Robert Putnam, *Making Democracy Work* (Princeton, NJ: Princeton University Press, 1993).

SOURCE: Office of Technology Assessment, 1995.

incorporated into development policies.[137] To explore such questions, the Clinton Administration has recently constituted the Council on Sustainable Development, which is composed of 25 U.S. government, business, and environmental leaders. This council, meeting for two years, aims to develop a set of plans and policies to ensure continued economic growth without damage to human health and natural resources.[138] Other governments and organizations are pursuing similar efforts.[139]

More recently, new policy goals such as poverty alleviation and the promotion of women's rights, are also being brought to the fore. Although international meetings such as the World Summit on Social Development are necessary to highlight the need to pursue such goals, care must be taken to assure that—like sustainability—these goals are not pursued single-mindedly but are rather incorporated into a broad-based development program.

Comprehensive foreign assistance programs can serve not only to promote holistic development; they can also foster improved trading relationships with Third World countries at a time when these markets are rapidly growing in size. Development programs that are based on reciprocal, cooperative interactions among donors and recipients can generate ongoing social and economic networks that spill over into trading relation-

[137] Maurice F. Strong, "From Rio to Copenhagen," *Futures*, vol. 27, No. 2, March 1995, pp. 238–240.

[138] Glen Hess, "President's Council Seeks Growth While Protecting Environment," *Chemical Marketing Reporter*, vol. 245, No. 17, April 25, 1994, p. 27.

[139] Included among these, for example, are Holland's National Environmental Policy Plan, *To Choose or To Lose*; the UK's White Paper, *This Common Inheritance and Sustainable Development: The UK Strategy, 1994*; Japan's *New Earth 21*; and the European Commission's Fifth Environmental Action Programme—*Toward Sustainability*. Also underway is the 2050 Project, a 4-year effort by the World Resources Institute, the Brookings Institute, and the Santa Fe Institute to define the conditions under which the global society might be sustainable in the year 2050.

BOX 2-5: Japanese Support for Standard Setting

The Japanese have sent technical experts to five developing countries to assist them in the development of their standards program. In the Philippines, for example, the Japanese International Cooperation Agency conducted a 13-person team, 500-person-day study of the Philippine national standardization system and provided a U.S.$23.1 million grant to establish three regional labs. At the same time, the Japanese Government has paid for 28 people from developing countries to come to Japan for language and technical standards training.

SOURCE: Office of Technology Assessment, 1995.

ships. Participating donor countries can gain a considerable competitive trade advantage as a result without violating the principles of free trade.

The Japanese have been particularly successful in establishing these kinds of aid networks (see box 2-5). Now the world's largest donor country—with contributions totaling $11.26 billion in 1993—Japan has recently moved to broaden its assistance programs to focus more on environmental, population, and healthcare goals.[140] At the same time, the proportion of Japanese aid that is tied to the purchase of Japanese products is on the decline. In 1993, for example, 82.9 percent of Japan's total overseas development assistance was untied, as was 96.9 percent of its foreign assistance loans.[141] Instead of using tied aid to promote its commercial ends, the Japanese are leveraging their own economic development model, in the hope that trade will follow the path of shared research, training, technology transfer and personal exchanges. Not surprisingly, therefore, much of Japan's aid is centered in Asia, which is fast becoming Japan's largest market.[142]

A FOREIGN ASSISTANCE MODEL FOR THE FUTURE

Notwithstanding the growing disillusionment and disappointment in the outcomes of many foreign assistance programs, foreign aid will probably continue to serve as major policy instrument in the United States foreign policy repertoire. Just as the Cold War led a reluctant Congress to provide concessionary aid in the 1950s, and the foreign debt crisis in the 1980s led the Reagan Administration to help resolve the international debt crisis, so future governments will likely utilize foreign aid policy in an effort to limit the damage due to environmental impacts, natural disasters, civil wars, and international conflicts. Given such a likelihood, it behooves foreign policymakers to reflect on past successes and failures.

Looking at any one particular segment of time, U.S. foreign assistance appears to conform to a model in which goals, policy tools, policy mechanisms, and policy outcomes are laid out in a linear fashion. Standing back and surveying the last 50 years all at one glance, however, the picture is not quite so orderly. Although overall goals have remained relatively stable over time—albeit with some shifts in emphasis—the means adopted to achieve them have been altered quite abruptly, as new situations arose, different political ideologies gained prominence, and new models of economic development came into vogue. Seen from this long-term perspective, foreign assistance corresponds much more to the sharp swings of a pendulum. Thus, for example,

[140] Hiroshi Hirabayashi, "Changes in the International Environment and the Direction of Japan's ODA," *Japan 21st,* vol. 39. No. 12, December 1994, pp. 23–27; and Peter Evans, "Japan's Green Aid," *The Chinese Business Review*, July/Aug. 1994, pp. 39–43.

[141] Ibid.

[142] Jonathan Friedland, "The Regional Challenge: Asia Has Become Japan's Biggest Market," *Far Eastern Economic Review*, June 9, 1994, pp. 40–42.

whereas at one point the transfer of capital was viewed as the key to success, the emphasis soon thereafter shifted 180 degrees to a poverty-oriented, basic needs approach, later moved again in a radically different direction with attention focused on structural economic reforms, economic sustainability, and more recently back again to poverty alleviation and basic needs.

Having focused on a single "right" way of achieving economic development, which presumably could be applied to all settings and circumstances, policymakers reacted to each failure by darting off in new directions in search of new solutions. Little effort was made in the process to draw on the more positive aspects of each approach so as to weave them into a comprehensive package.

Today, the United States' stake in the fate of Eastern Europe and the developing world is commensurate with its interest, 50 years ago, in the revival of postwar Europe. Just as in 1945—when the U.S. government recognized that its own economic recovery was dependent on that of Europe—so today policymakers find that the United States' greatest trading opportunities are now situated in Eastern Europe and the Third World. If the United States is to benefit from these opportunities, it will need to promote the health of Third World economies as well as their successful integration into the global economy. As the debt crisis and—more recently—the devaluation of the Mexican peso makes clear, in an increasingly global economy, economic problems, even when they emerge in developing countries, quickly reverberate throughout the industrial world.

U.S. security interests are also inextricably tied to Third World developments. Just as the United States adopted the Marshall Plan in an effort to shore up the power vacuum created by the collapse of the interwar international system, so the U.S. government is increasingly being called on to maintain peace across the globe. Given the demise of the Soviet Union and—with it—the collapse of the Cold War defense system, states and political regimes are, one by one, coming apart at the seams. To "contain" the violence, the United States has found it necessary to become engaged in 21 new peacekeeping operations in the period between 1988 and 1994 (as opposed to 13 during the period from 1947-1988).[143]

Developing appropriate foreign aid policies to address these global challenges can benefit greatly from the lessons of the past. The case of the Marshall Plan is particularly instructive, given its fundamental success. What distinguishes the Marshall Plan experience from subsequent aid programs is the extent to which aid policy tools were tailored—whether purposefully or not—to the situation at hand (see table 2-3). Equally important was the degree to which policy tools served to reinforce multiple foreign aid goals.

Thus, for example, the U.S. decision to make aid contingent on European structural economic reforms was coupled with changes in the U.S. economy as well as to the broader revision of the international monetary system. Similarly, the transfer of financial capital to Europe was linked to the prospect of future U.S. trade opportunities there. Likewise, postwar defense arrangements in Europe not only served to protect the West against the Soviet threat; they also promoted regional political stability so that Western European governments could focus their attention on cooperation and economic growth.

Today's situation is considerably less conducive to success, as can be seen in table 2-3. Trade policies are now intensely competitive; fewer resources are available for aid; the United States and other donor countries are increasingly preoccupied with domestic issues; the goals of the United States and recipient countries (as well as other donor countries) are often in conflict; recipient countries lack the political and social resources to fully benefit from aid, etc.

[143] Mark M. Lowenthal, *Peacekeeping and U.S. Foreign Policy: Implementing PDD-25*, CRS Issue Brief, IB94043, Updated Sept. 23, 1994.

Designing successful aid programs in this context will be very challenging indeed. To be successful, aid policies must not only promote economic growth; they must also foster the development of social, political, and economic institutions that are conducive to the generation and equitable distribution of wealth. These policies will, moreover, need to be implemented using fewer resources spread over a broader array of situations and locales. Thus, aid policies will need to be highly cost-effective and mutually reinforcing, pooling and leveraging resources whenever possible.

Despite previous disappointments and the prospect of even greater challenges in the future, foreign aid will likely continue to serve as an important policy tool for fostering U.S. foreign policy goals. In an increasingly interdependent, global economy, the alternatives to foreign aid—whether they be national isolationism or the use of military force—will often be counterproductive.

Drawing on the lessons of the past in the light of the present conditions, table 2-3 identifies a number of policy strategies that, when joined together into an integrated package, might serve as the basis for developing a revised foreign aid model that is more suitable for today. At a minimum, in fashioning telecommunication-related aid policies to promote the United States' foreign policy goals, these strategies can serve as a useful starting point.

TABLE 2-3: Criteria for Successful Development Aid

Key Factors	Status of World Economic Regulation	Quantity and Allocation of Resources Devoted to Aid Programs	National Support/ Perceived Stakes Involved
Marshall Plan	Expanding trade m the context of trade liberalization and internationally coordinated post-War monetary system	High levels of mutually reinforcing financial and military commitments were focused on Europe The U S spent $554 billion (an average of $138 billion in 1981 prices) Joint participation in defense arrangement with the formation of NATO	Stakes were perceived as very high and linked to the notion of containing the Soviet threat President Truman's Four Point Program provided a vision to sustain political support for aid.
Today's Context	Increased integration and interdependence in global economy, driven by growth in trade, transnational corporations and financial institutions Aggressive trade policies to capture big emerging markets Trade liberalization accompanied by new forms of protec-tionism Strain on post-War international monetary system	Dollar amount of economic aid in the aggregate is equivalent to the Marshall-Plan era, but resources are spread more thinly and unevenly Areas requiring economic aid are not necessarily the same as those requiring military assistance. A large proportion of U.S. assistance focused on strategically important areas such as Egypt and Israel,	Shift in concern from international issues to domestic problems — growing Federal debt General questioning of the cost-effectiveness and success of aid programs
Today's Policy Challenge	Incorporate developing countries into the global economy with win-win outcomes for all	Develop more cost-effective ways to promote aid goals	Greater vision for aid policy that better relates to present U.S. priorities and concerns (i.e., trade).
Today's Policy Criteria	1) Develop mutually beneficial trade agreements. **2)** Aid to support global economic institutions m developing countries -— i e standards, financial markets, infrastructure privatization, regulatory reform	1) Leverage across programs and agencies 2) Gain economies of agglomeration by focusing comprehensive programs more locally	1) Global exchange programs 2) Involvement of business and other key groups in executing aid programs

TABLE 2-3: Criteria for Successful Development Aid (Cont'd.)

DDonor/Recipient Relation ship	Social/Political/institutional Context of Recipient Countries	Measurabilit y of Success/ And Feedback	Key Factors
Aid to Europe provided on a quid-pro-quo basis involving economic reforms and European regional cooperation. But U S and Europe were in basic Ideological agreement about post-War priorities and institutions Europeans negotiated and helped design the structure of the Marshall Plan	A shared common history and continuity of political and economic institutions and a socioeconomic infrastructure was capable of absorbing and efficiently allocating aid resources	Aid programs fostered both economic and security goals and were perceived as being highly effective Because of its widely acclaimed success, the Marshall Plan served as the respiration for U S bilateral aid to developing countries,	Marshall Plan
We-They attitude persists as a result of debt crisis when donors imposed conditions on aid recipients. Developing countries are now more inclined toward liberalization and greater integration into the world economy, but many find Asian development model more appealing than U.S. version.	Diverse settings, weak institutional frameworks, problems of political disorder and social upheaval	Few concensus measures of success General perception of poor performance and f failure of aid to have an impact. Inadequate feedback mechanisms to achieve aid accountability and improve development models	Today Conte
Find ways to negotiate aid agreements that enhance donor-recipient cooperation and that are mutually responsive to both sets of needs	Develop comprehensive aid programs that foster social/political institution-building without undermining economic reforms	Enhance our understanding of the development process and develop qualitative and quantitative measures to better evaluate aid programs	Today's Policy Challenge
Revitalize existing forums or establish new forums that cut across G7/G66 boundaries where aid conditions can be negotiated in the context of joint interests	Incorporate into aid policies mechanisms to foster cooperation that build on existing cultural strengths and social networks	1) Experiment with small, Innovative pilot projects **2)** Develop databases and networks for collecting and disseminating aid-related information and results	Today's Policy Criteria

SOURCE: Office of Technology Assessment, 1995.

Communication Technologies to Promote Foreign Aid Goals

3

The foreign aid goals of promoting sustainable economic growth, democracy, and political stability do not always go hand in hand. For these goals to be mutually reinforcing, aid policies must be designed to foster a number of criteria. Developing countries must have access to new growth opportunities, and their markets must be free and competitive to better take advantage of them. In addition, their governments must be representative, accountable, and competent in meeting public needs. Finally, their citizens must engage with one another, and cooperate to find solutions to common problems.

Recent advances in communication technologies provide new opportunities for developing countries and foreign aid organizations alike to help meet these criteria. To expand their trading opportunities, for example, developing countries can use high-speed broadband global networks to link up to foreign markets. Similarly, low-cost networked information technologies, such as the Internet, can be used to facilitate political and community participation. Equally important, social services—such as health care and education—can now be provided via satellite on a much more cost-effective basis.

Recognizing this potential, many developing countries are poised to make major investments in communication infrastructure in the hope of fostering economic development and facilitating the integration of their markets into a knowledge-based global economy. Foreign assistance organizations are similarly considering telecommunication-related programs to reduce the costs and enhance the benefits of providing foreign aid.

The time is ripe to make such investments. The costs of communication technologies are plummeting, while their performance is improving phenomenally. Soon these technologies will be essential given an increasingly information-based and electronically networked global economy. Countries that take advantage of these technologies will gain competitive advantages, while countries that fail to recognize the potential, or who cannot gain access to these technologies, will probably experience decline. In Third World countries, advanced communication technologies can play a special role. These technologies not only allow countries to leapfrog to a modern infrastructure; they can also serve as a catalyst, helping to promote social and economic behavior more conducive to development.

Although recent advances in communication technologies hold promise to improve political and economic conditions in Third World countries, the realization of this promise is far from certain. As history bears witness, the evolution of technologies is replete with disappointments and unintended consequences.

If communication technologies are to prove effective, their capabilities and characteristics must be well matched to the task at hand. Communication technologies are not equal in this regard; for any given purpose, some are much more suitable than others. If, for example, communication technologies are to have a democratizing effect, they need to be widely available, easily accessible, and capable of supporting two-way interactions. On the other hand, communication technologies that are intended to reinforce a sense of community, or to support activities internal to a particular business or firm, may need to be more restrictive with respect to both content and access.

Successful outcomes also depend on the social, economic and political context in which technologies are deployed. If, for example, developing countries do not have the requisite skills and expertise, they will be unable to use technologies effectively. Equally important, if Third World leaders use communication technologies solely to perpetuate their own control, or to reinforce unproductive practices, technology deployment may serve to make countries worse off. To be effective, technology deployment strategies must be closely linked to complementary social and economic policies that address other, often more formidable, developmental barriers.

The stakes in selecting appropriate technology policies for development are extremely high. Many of these choices will be irreversible, at least in the short and medium terms. Once a decision is made, technology tends to become firmly fixed on a given trajectory.[1] This pattern is especially evident with networked information technologies, which require vast amounts of capital and social investment. Thus, periods of rapid technology advances, such as are occurring today, provide a rare opportunity for reassessing and redirecting both the nature of a particular technology itself, and the economic and social relationships that are structured around it.[2]

This chapter seeks to better inform this important decisionmaking process. To this end, it does the following: 1) presents a framework for analyzing communication technologies and social change; 2) lays out the existing evidence relating technology change to economic development, democracy, and political stability; 3) characterizes the range of situations presently to be found in developing countries; 4) identifies recent trends and advances in communication technologies; and 5) analyzes the implications of these trends for developing countries.

A FRAMEWORK FOR ANALYZING COMMUNICATION TECHNOLOGIES AND SOCIAL CHANGE

Communication technologies have little direct impact on society. Rather, they affect relationships, indirectly, by providing structure to communication processes. It is communication processes themselves—which may or may not be technology based—that give rise to social opportunities and impacts. Advances in communication technologies can, however, provide a catalyst for change. By altering the nature of communication processes as well as human perceptions, they can restructure the way that people interact and carry out activities.[3] To evaluate the potential of new communication technologies to promote foreign aid goals, it is necessary to define and characterize these interconnections.

[1] Brian W. Arthur, "Positive Feedbacks in the Economy," *Scientific American,* February 1990, pp. 92–99.

[2] For a discussion of how institutions get locked in, see Douglas North, *Institutions, Institutional Change, and Economic Performance* (Cambridge, UK: Cambridge University Press, 1990).

[3] See Daniel Katz and Robert L. Kahn, *The Social Psychology of Organizations* (New York, NY: John Wiley & Sons, Inc., 1966).

Communications Defined

To relate communication and information technologies to the process of economic development, democratization, and political stability requires a definition of communication that can serve equally to describe social phenomena as well as technology. Previous ways of defining communication are inadequate in this regard, so a working definition for this discussion is needed (see box 3-l).

The word "communicate" comes from the Latin root *"communis,"* signifying communion or the idea of a shared understanding of, or participation in, an idea or event. In this original sense of the word, communicate was used as a noun of action that meant "to make common to many (or the subject thus made common)."[4] Toward the end of the 17th century, the notion of imparting, conveying, or exchanging information and materials was incorporated into the concept.

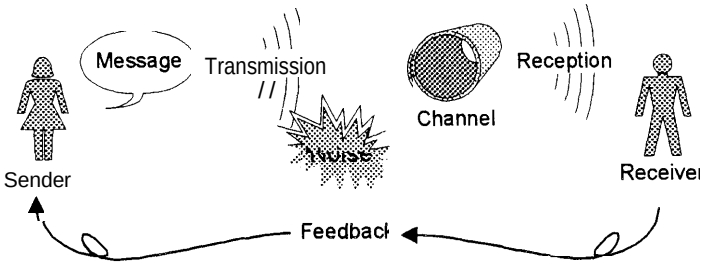
BOX 3-1: The Shannon-Weaver Model o

Academic researchers have traditionally defined communication in accordance with the sender/receiver model developed by Shannon and Weaver in their work on information theory.[1] As depicted below, this model characterizes communication as a systemic process, the main components of which include: sender, message, transmission, noise, channel, reception, and receiver, Despite a long history, this model is less useful today, given the convergence of information and communication technology and an interactive, multimedia environment in which communication no longer takes place in a linear fashion. With a computerized bulletin board, for example, how does one identify and distinguish between who is the sender and who is the receiver of a message? And similarly, who is considered the sender of a message when the receiver can now access information on demand?

The Shannon and Weaver model is also inappropriate for analyzing social processes and policy issues, The somewhat passive notions of "message," "sender," and "receiver, " draw attention to the problems of effective communication. However, they downplay any problems involved in, or issues about, who gets to formulate, send, and access information; on what basis, and with what objectives and effects, It is, in fact, precisely these kinds of issues that may determine whether, and the extent to which, communication and information technologies serve U.S. foreign aid goals.

1 Claude Shannon and Warren Weaver, The Mathematical Theory of Communication (Urbana, IL: University of Illinois Press, 1949), p. 5.

SOURCE: Office of Technology Assessment, 1995

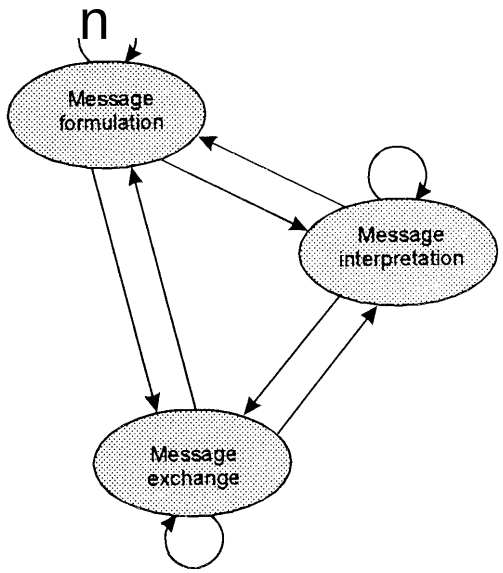


4 Daniel Czitrom, *Media and the American Mind* (Chapel Hill, NC: The University of North Carolina Press, 1982), p. 10

This sense of the term became increasingly popular with the development of railroads, canals, and roads.[5] Both connotations are germane to the issues addressed here.

To incorporate both perspectives, this study defines communication as "the process by which messages are formulated, exchanged, and interpreted." As depicted in figure 3-1, which describes this communication process, the definition used here assumes that these three activities are related to one another in a process insofar as they are all required for an act of communication to take place. In light of interactive technology, however, the process in which these activities are related is not considered to be linear; nor does the process entail a predictable sequence of events. Technology and human beings are also understood to be interchangeable at any point in the process, and they can come together in any number of ways. Moreover, the process of communication is not viewed, as in the past, as a mere transmission process. As defined here, it includes the application and content that is communicated.

FIGURE 3-1: The Communication Process



SOURCE: The Office of Technology Assessment, 1995

Communications and Society

Defined broadly in this fashion, it is clear that communication is the basis for all human interaction and one of the means for establishing and organizing society. Without it, a society could not survive. It is the means by which group norms are established, expectations are voiced, individual roles are assigned, change is enacted, and social control is exercised.

Communication, for example, is inherent in the coordination of all economic activity. The exchange of information is at the heart of the market system.[6] A market relies on the communication of information to identify buyers and sellers, allocate resources, and establish prices. Within firms, the availability of timely and accurate information is key to decisions about whether to enter or exit markets; how to secure financing; how to organize working relationships; and how to market and distribute goods. Where adequate information is not available, markets will fail and economic performance will suffer because of higher business costs. Likewise, firms that lack adequate market information will be at a competitive disadvantage.

Communication and information also pervade political life. Without them there could be no nation; for it is through the process of communication that people first develop a sense of community and a shared set of values that legitimize political authority.[7] By magnifying and amplifying some actions, the communication process distinguishes between what is a private act and what is a public affair. It organizes what appear to be random activities to show how individuals and groups are related to one another in the pursuit of power, providing a roadmap for individu-

[5] Ibid and Raymond Williams, *Key Words: A Vocabulary of Culture and Society* (New York, NY: Oxford University Press, 1976), pp. 62-63.

[6] For an in-depth discussion, see James R. Beniger, *The Control Revolution: Technology and the Economic Origins of the Information Society* (Cambridge, MA: Harvard University Press, 1986).

[7] See Karl Deutsch, *Nationalism and Social* Communication (New York, NY: Free Press, 1963).

als who want to influence the course of political events.[8] Citizens rely on the communication process to gather information; identify like-minded people; organize their forces; and articulate their political preferences. Furthermore, because it generates a common fund of knowledge and information, the communication system facilitates productive and rational debate. Without some form of knowledge and understanding of how others are informed and what they believe, individuals could not make reasoned and sensible arguments and decisions.[9]

Communication is similarly the process by which culture is developed and maintained. Only when people develop language, and thus a way of communicating, can a culture emerge and be imparted.[10] Information—the content of communication—is the basic source of human intercourse. Thus, the communication of information permeates the cultural environment and is essential to all aspects of social life. It is the means by which knowledge is created and shared, roles are negotiated, and social relationships are legitimated.[11] Through communication, culture is both maintained and changed; behaviors, and the values that underlie them, are accepted, questioned, or reinterpreted according to circumstances.[12]

Supporting all forms of human activity, communication runs like a thread entwined throughout the course of history. As Lucian W. Pye has described it:

> Communication is the web of human society. The structure of a communication system with its more or less well-defined channels is in a sense the skeleton of the social body which envelops it. The content of communications is of course the very substance of human intercourse. The flow of communications determines the direction and the pace of dynamic social development. Hence it is possible to analyze all social processes in terms of the structure, content, and flow of communications.[13]

How communications processes are ordered, therefore, will have a major impact on developing countries and their ability to achieve economic, political, and social goals.

Technology Advance as It Affects Communication Processes and Economic, Political, and Social Outcomes

Communication processes do not occur in a vacuum; they are facilitated and sustained by an underlying network of individuals, institutions, and technologies that provide the means and mechanisms for formulating, exchanging, and interpreting information, and for creating the necessary linkages among these activities. As part of the infrastructure, communication and information technologies not only support communication processes; they also mediate them, restructuring the way in which they take place.

Communication and information technologies can affect communication processes in a variety of ways. For example, they can alter:

- the speed of communication,
- the cost of communication,
- the distance that, within any given period of time, information can travel,
- the amount of intelligence/functionality that can be transferred,
- the relationships and interdependencies among parties to an act of communication, and
- the perceptions of the parties communicating.

It is these changes in communication processes—*and not the actual deployment of tech-*

[8] Lucian Pye (ed.), *Communications and Political Development* (Princeton, NJ: Princeton University Press, 1965), p. 6.
[9] Ibid.
[10] Beniger, op. cit., footnote 6, pp. 84–91.
[11] Donald P. Cushman and Dudley D. Cahn, Jr., *Communication in Interpersonal Relationships* (Albany, NY: State University Press, 1985); and Martin Lawrence LeFleur, *Theories of Communication* (New York, NY: David McKay Co., Inc., 1970).
[12] When people communicate, meaning is both assumed and negotiated—some things are taken for granted, and others are interpreted in new ways or brought up for explicit discussion. When people communicate, they are both differentiating and integrating—displaying their distinctiveness as well as demonstrating their commonality.
[13] Pye, op. cit., footnote 8, p. 4.

nology itself—that eventually gives rise to social and economic opportunities and impacts. Thus, for example, communication technologies such as fiber optics and optical switches, which increase the speed and reduce the cost of communication, can foster economic growth by permitting a greater number of transactions to take place. Similarly, inexpensive, stand-alone media technologies—such as videotapes and video cameras—have served in Eastern Europe and a number of developing countries to enhance political participation (and, on occasion, to increase political instability) by reconfiguring relationships so that citizens could bypass existing information gatekeepers.

Because the impacts of communication technologies are indirect, change takes place in an evolutionary, rather than a revolutionary, fashion.[14] Moreover, the path change follows is not direct; it zigzags and meanders in response to the openings and obstacles encountered along the way (see box 3-2).[15]

Technology advances are tempered by social forces as well as by the historical conditions under which new technologies are brought into use.[16] These forces often override the idealistic aspirations and hopes that are attached to technological change. If, for example, the social and technological infrastructure is inadequate to exploit the benefits of new advances, some technologies will be slow to develop or perhaps never be applied at all.[17]

Whether or not new technologies are developed, and who bears their costs and reaps their benefits, will also be determined by the responses and reactions of those who have a stake in maintaining the status quo.[18] Made in the context of existing institutional structures, laws, and practices, technology choices will depend on who the key decisionmakers are; how they perceive their needs, interests, and objectives in the light of new technology; and the power and authority they have to determine events.

RELATING CAUSES TO EFFECTS

Given the complexity of the relationships involved, anticipating how communication technologies might affect the prospects of Third World countries is decidedly difficult. Nonetheless, to make sound telecommunication investments, developing country leaders and foreign aid providers must assess the full range of associated benefits and costs. They also need to under-

[14] As described by Braudel with respect to the industrial revolution, "When one is talking about social phenomena, rapid and slow change are inseparable. For no society exists which is not constantly torn between the forces—whether perceived as such or not—working to undermine it. Revolutionary explosions are but the sudden and short lived volcanic eruption of this latent and long term conflict." Fernand Braudel, *Civilization and Capitalism 15th-18th Century: The Perspective of the World*, vol. 3 (Berkeley, CA: University of California Press, 1992), pp. 537–538.

[15] Analytical models differ with respect to the degree and timing of how society and technology influence one another. According to one school of thought, technology is essentially neutral before it has been developed. And it is only as technologies are exploited and molded in accordance with particular social, economic, and political conditions that they take on a determining force of their own. For this view, see Clifford Christians, "Home Video Systems, A Revolution?" *Journal of Broadcasting*. vol. 17, 1973, pp. 223–234. Others think of technologies as being biased in favor of particular outcomes at the moment of their conception because they are envisioned and designed with certain purposes and practices already in mind. For this perspective, see Raymond Williams, *Television Technology and Cultural Form* (New York, NY; Schockien Books, 1973).

[16] The development of the penny press is one example. Many social reformers hoped that it could be used to reestablish a broad moral and political consensus across the United States after the turmoil caused by the Civil War. Social and economic conditions worked against them, however. The penny press emerged not only in a period of cultural upheaval and transition, but also in a period of intense competition for advertisers and readers. Instead of trying to improve the cultural and moral standards of people, newspaper publishers felt compelled to adopt any sensationalist device so long as it would bring in additional readers. Czitrom, op. cit., footnote 4, pp. 92–93.

[17] Such was the case in ancient Alexandria, for example. Although inventors had the theoretical knowledge necessary to create primitive versions of a steam engine and a wheeled cart, these ideas lay dormant and only became practicable in application centuries later in conjunction with the industrial revolution. Langdon Winner, *Autonomous Technology: Technics Out of Control as a Theme in Political Thought* (Cambridge, MA: MIT Press, 1977), pp. 11–12.

[18] For an historical account of the conservative role that communication stakeholders played with respect to new technology developments, see Brian Winston, *Misunderstanding Media* (Cambridge, MA: Harvard University Press, 1986), pp. 15–34.

BOX 3-2: The Printing Press as an Agent of Change

The printing press had a major impact on Europe.[1] In fact, the printing press is often viewed as a "revolutionary" information technology responsible for the Reformation. Its incorporation into the existing social, economic, and political framework occurred over time, so its impact was filtered by historical events.

Printing greatly increased the speed and reduced the costs of reproduction, and thus facilitated the dissemination of ideas. By increasing the general level of literacy, it also made more people susceptible to, and eager to partake of ideas. As a result, the market for information products and literary works grew, and the economic value of these works was greatly enhanced. Later, as books and manuscripts moved beyond monastery shelves and became simultaneously available to many people, they began to serve as an important forum for public discussion. Printing and the widespread use of books also fostered new relationships among scientists, artists, intellectuals, and their geographically distant counterparts. As Eisenstein has pointed out:

> The fact that identical images, maps, and diagrams could be viewed simultaneously by scattered readers constituted a kind of communication revolution itself.[2]

Occurring at the time of religious and political turmoil, printing presented the monarchs of Europe with both a political threat and an economic opportunity. While direct censorship was the most effective means of confronting the political threat brought about by the new technology, it also stifled the printing industry, and thus limited the government's economic benefits from printing. Seeking to both end the dissemination of heretical and seditious literature, but still profit from the burgeoning printing trade, the English government aligned itself with publishers. In exchange for an agreement to enforce the censorship laws, the government granted the publishers' guild, known as the Stationers, a monopoly right to print, publish, and sell works—a copyright.[3]

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[1] For the classic account, see Elizabeth L. Eisenstein, The Printing Press as an Agent of Change: Communications and Cultural Transformations in Early Modern Europe, vols. I and II (Cambridge, England: Cambridge University Press, 1982).

[2] Ibid., vol. 1, p. 56.

[3] Stephen Stewart, *Law of International Copyright and Neighboring Rights* (London, England: Butterworths & Co., Ltd., 1983).

SOURCE: Office of Technology Assessment, 1995.

stand the conditions under which success will most likely occur.

To gain a sufficiently broad understanding of these issues, it is useful to consider historical evidence drawn from analogous situations. Only an historical picture can capture all the variables and their relationships to one another. Comparing historical inferences to statistical data, it is then possible to suggest whether, and the extent to which, the conclusions of such analyses might be generalized.

An Historical Overview

To select an historical case that is somewhat analogous to the situation in developing countries today, one need look no further than the United States. Judged by European standards of the time, the United States was, in its earliest years, "underdeveloped." By the turn of the 19th century, however, the United States had been forged into a major industrial nation spanning the continent and a multiplicity of cultures. Telecommunications, as described below, played a major role in this economic and political transformation.

The important role that communication (and transportation) technologies played in the rise of the United States economy can be seen by tracing the development of these technologies in conjunction with the nation's industrial develop-

ment. Between 1830 and 1887, a plethora of new technologies emerged, which gradually replaced many of the social and institutional communication networks that had hitherto sustained economic activities in the New World (see table 3-1). The deployment of these technologies, together with the social and organizational changes that they facilitated, increased economic activity and fostered economic growth in a number of interrelated ways, many of which served to reduce transaction costs (see appendix A for a detailed account).

These effects can be summarized as follows. First, communication technologies dramatically increased both the speed and the number of economic transactions that could take place. Second, by diminishing the relevance of geographic distance, communication technologies facilitated the expansion of trade and markets. At the same time, the development of mass media technology served to reinforce national markets by helping to mold tastes and preferences into a more uniform cast. This increased market size, in turn, led to greater specialization, standardization, and economies of scale. By enhancing intrafirm coordination, communication technologies allowed businesses to grow vertically and horizontally, and thus to exploit these economies.

Communication technologies also restructured relationships among economic actors, making some better and some worse off. Most vulnerable were those who—like jobbers and local retailers—were either replaced or bypassed, by technology. Winners were those who, being the first to gain access, were able to use communication technologies to reorganize their activities in response to the fundamental social and economic changes entailed in the process of industrialization, thereby gaining a competitive advantage.

The role of communication, however, was not constant over time. Rather, it increased along with technology advance, and as markets grew and business processes became more complex and information-intense. Initially, for example, middlemen and their personal networks provided the medium by which market information was transported, and market interactions consisted almost entirely of face-to-face exchanges. With the onset of industrialization, mediated communication replaced most of this primary contact.

Just as communication technologies served to promote U.S. economic growth and development, so too they played a critical role in the political evolution of the United States. Like political leaders in many developing countries today, the U.S. Founding Fathers were faced with the mammoth task of "building" a nation in the context of a democratic political system. At a minimum, this effort entailed establishing national sovereignty and national security; maintaining internal security and social welfare and ensuring an open political system based on participation, deliberation, and representation.[19]

Communication technologies, and the rules that governed their use and development, were critical not only to carry out these activities, but also in determining the relationship—as well as resolving the tensions—among them (see appendix A for a detailed description). Serving as a mechanism for both national integration as well as individual (and group) differentiation and participation, these technologies provided a mechanism for balancing the need for political participation as well as social control (see box 3-3).[20]

[19] The United States was designed to be a representative or republican form of government. This design reflects the Founders' belief that, while government should be based on popular sovereignty, it should also protect the minority against majority rule. Thus while power was given to the people, it was done in a limited, or restricted, fashion. Qualified participants were defined narrowly to include only white, property-owning males. Moreover, the President and the Senate were not directly elected by the people but rather were indirectly chosen by the Electoral College and the State legislatures. And finally, "the people" were themselves divided into two constituencies—one at the federal and one at the state level.

[20] For example, many political theorists have argued that some constraints are necessary in order to preserve democracy. Aristotle, for example, favored "constitutional government" but was opposed to "direct democracy," which he called perverted because it failed to protect the rights and interests of the minority. James Madison made much the same case in *The Federalist Paper. Aristotle in Twenty-Three Volumes, XXI Politics*, translated by H. Rackham (London: Heineman, 1977), Book III, p. 207.

TABLE 3-1: Selected Innovations in Information Processing and Communication, 1830–1887

Year	Innovation
1830s	Wagon lines carrying freight between rural towns and ports begin to operate on regular schedules.
1837	Telegraph demonstrated, patented.
1839	Express delivery service between New York and Boston organized using railroad and steamboat.
1840s	Freight forwarders operate large fleets on canals, offer regular through-freight arrangements with other lines.
1842	Railroad (Western) defines organizational structure for control.
1844	Congress appropriates funds for telegraph linking Washington and Baltimore; messages transmitted.
1847	Telegraph used commercially.
1851	Telegraph used by railroad (Erie). First class mail rates reduced 40–50 percent.
1852	Post Office makes widespread use of postage stamps.
1853	Trunk-line railroad (Erie) institutes a hierarchical system of information gathering, processing, and telegraphic communication to centralize control in the superintendent's office.
1855	Registered mail authorized, system put into operation.
1858	Transatlantic telegraph cable links America and Europe, service terminates after 2 weeks.
1862	Federal Government issues paper money, makes it legal tender.
1863	Free home delivery of mail established in 49 largest cities.
1864	Railroad postal service begins using special mail car. Postal money order system established to insure transfer of funds.
1866	Telegraph service resumes between America and Europe. "Big Three" telegraph companies merge in single nationwide multiunit company (Western Union), first in United States.
1867	Railroad cars standardized. Automatic electric block signal system introduced in railroads.
1874	Interlocking signal and switching machine, controlled from a central location, installed by railroad (New York Central).
1876	Telephone demonstrated, patented.
1878	Commercial telephone switchboards and exchanges established, public directories issued.
1881	Refrigerated railroad car introduced to deliver Chicago-dressed meat to Eastern butchers.
1883	Uniform standard time adopted by United States on initiation of American Railway Association.
1884	Long-distance telephone service begins.
1885	Post Office establishes special delivery service.
1886	Railroad track gauges standardized.
1887	Interstate Commerce Act sets up uniform accounting procedures for railroads, imposes control by Interstate Commerce Commission.

SOURCE: Reprinted by permission of the publishers from *The Control Revolution* by James R. Beniger, Cambridge, MA: Harvard University Press. Copyright 1986 by the President and Fellows of Harvard College. All rights reserved.

BOX 3-3: Politics and Communication Technologies

Political organization is constrained by the prevailing modes of transportation and communication, and it changes with advances in these modes. Before the age of modern communication and transportation, political philosophers—ranging from Plato and Aristotle to Rousseau and Montesquieu—agreed that size and population served to limit democracy. Based on the model of the Greek city-states, the ideal size for a democracy was a unit "so small that any citizen could travel on foot from the most remote point in a city-state to its political center and return in one day."[1] Similarly, the population of a democracy had to be small and contained enough to allow interaction among its members. A polity so configured provided not only for popular representation, but also for effective government administration.

[1]James W. Carey, *Communication as Culture: Essays on Media and Society* (Boston, MA: Unwin Hyman, 1989), p. 3.

SOURCE: Office of Technology Assessment, 1995.

Summarizing how communication technologies affected the evolution of American politics, four major impacts can be identified. First, communication technologies helped to integrate the nation by extending nationally oriented messages over broad geographic areas in a manner that bypassed traditional local, cultural, or socially based information gatekeepers. Second, communication technologies simultaneously provided mechanisms for individuals and groups to access information, identify and organize like-minded people, and promote their ideas at all levels of government, thereby holding the government accountable and assuring the representation of their views. Third, communication technologies provided government the means to administer laws, maintain order, assure the national defense, and promote the general welfare in an increasingly complex and interdependent social and economic environment, which required dealing with events such as industrialization, the Depression, and the Second World War. Finally, by supporting all of these functions on a relatively equal basis, communication technologies helped to maintain the balance—necessary to sustainable democracy—between participation and control.

Looking at the role of communication technologies in American politics, however, it is clear that these technologies have been neither equivalent nor technologically neutral with respect to political outcomes. The telegraph and mass media not only fostered national integration; they also diminished the interests of particularistic groups. The telephone, on the other hand, facilitated political organization at all levels. Cable broadcasting increased the number of outlets available for competing political perspectives. With such a wide range of communication technologies available, striking the appropriate balance between participation and control was more easily accomplished.

Channeling information to some gatekeepers while circumventing others, communication technologies also helped to determine the distribution and locus of political power. Over the course of American history, for example, the role of information gatekeeper was shifted from the local newspaper proprietor, to the legislative representative, to the political party leader, to the television news analyst, transforming American politics in the process (see box 3-4).

Although communication technologies strongly influenced American politics, these technologies were not autonomous in their effects. Fully aware of their political potential, the U.S. Founding Fathers established a basic legal framework in the Constitution that served to establish the general direction in which communication technologies have evolved. Within that framework, politicians, vendors, users and other stakeholders have all sought—both in the market-

BOX 3-4: The Role of Communication Gatekeepers

"...The important point about the way in which electronic and mass media operate is the fact that, as new sources of information or belief, they create counterweights to established authorities. Simultaneous radio coverage of the war, a moon walk or whatever absorbs and fascinates the mass audience directly, cuts out traditional local purveyors of information and interpretation. It is not the imam or the chief of state who tells the people what happened and what it means. The people were there, along with the camera crew. The broadening of the arena of action transfers authority from the village bigwig returned from a visit to the district town, to nouveau powerful national leaders and eventually beyond them to world figures."[1]

[1]Ithiel de Sola Pool, "Direct-Broadcast Satellites and Cultural Integrity," in Arthur Asa Berger (ed.), *Television in Society*, (New Brunswick, NJ: Transaction Books, 1987), p. 231.

SOURCE: Ithiel de Sola Pool.

place as well as in the political arena—to ensure that these technologies are developed in accordance with their preferences. Thus, in interpreting the impact of communication technologies in Third World countries, the specific institutional context in which they evolve must be kept in mind.

Statistical Evidence Linking Telecommunications to Economic Development and Democracy

Although historical evidence provides a good picture of the ways in which, and circumstances under which, communication technologies can affect economic growth, democracy, and political stability, it provides no real measures of the magnitude of such impacts. This kind of quantitative information is useful, especially when making investment decisions. Unfortunately, existing statistical analyses of the impact of telecommunications focus solely on the telephone, and on its impact on economic growth per se. Despite this limitation, these analyses do corroborate the conclusion that telephone deployment and economic growth are positively related. They suggest, moreover, that the benefits of telephone deployment are greater to the extent that deployment occurs in conjunction with other development-related variables—such as education and physical infrastructure development.

Statistical regression and correlation analysis relating telecommunications to economic growth dates back to 1963, when Jipp first demonstrated a strong correlation between telephone density and national wealth.[21] Since then, there have been a number of cross-sectional and time series studies linking telecommunications and economic development.[22] The conclusions of these analyses were inconclusive, however, because the models used were overly simplistic—accommodating only a few independent variables—and the data on telecommunications services—drawn from developed and less developed countries alike—were for the most part incomparable. Even more troublesome, these studies, while linking telecommunications deployment to economic growth, failed to demonstrate causality.[23]

[21] A Jipp, "Wealth of Nations and Telephone Density," *Telecommunications Journal*, July 1963, pp. 199–201.

[22] See, for discussions, Robert J. Saunders, Jeremy J. Warford, and Bjorn Wellenius, *Telecommunications and Economic Development* (Baltimore, MD: John Hopkins University Press, published for the World Bank, 2nd ed., 1994), pp. 85–98.

[23] Ibid.

More recent studies have addressed this problem of causation. For example, examining data from 60 nations for the years between 1960 to 1973, Hardy found that causality operated in two directions. Telecommunications investment increased to a significant degree with economic growth; similarly, although to a lesser degree, economic growth expanded along with investment in telecommunications.[24] Cronin, et al., came to a similar conclusion in their 1991 analysis, which was based on 31 years of U.S. data.[25]

To explain the relationship between telecommunications and economic development, Cronin et al. performed a sector-by-sector analysis looking at the impact of telecommunications on productivity.[26] Their quantitative results show that investments in telecommunications infrastructure are causally and significantly related to national total factor productivity.[27] The investigators found that advances in telecommunications production and enhanced consumption possibilities for end-userindustries account for 25 percent of the total direct and indirect aggregate productivity gains in the United States since 1978.[28] Dholakia and Harlam, using statistical data for the 50 states in the United States, also found a strong causal link between telecommunication infrastructure and economic development. Comparing resource inputs, using a multiple regression analysis, they found that the link between telecommunications and economic growth is greatest when inputs such as education and physical infrastructure are considered simultaneously.[29]

To explain the relationship between telecommunications and economic development, some researchers have pointed to the ability of telecommunications to reduce transaction costs (i.e., the information related costs entailed in doing business). According to Leff, for example, telecommunications not only lowers transaction costs within markets; these benefits also spill over to make other economic institutions more efficient.[30] Norton similarly found that reduced transaction costs due to telecommunications account for macroeconomic growth. His study suggests, moreover, that benefits of reduced transaction costs may be greatest for developing countries where adequate market information is very costly, to the extent that it is available at all.[31]

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[24] Andrew P. Hardy, "The Role of the Telephone in Economic Development," *Telecommunications Policy*, vol. 4, No. 4. December 1980, pp. 278–286. In this study, Hardy used a path analysis and cross-lagged correlation techniques, with time-lagged offsets on one year. See Heather E. Hudson, *Economic and Social Benefits of Rural Telecommunications: A Report to the World Bank*, March 1995, p. 11.

[25] Francis J. Cronin, Edwin B. Parker, Elisabeth K. Colleran, and Mark A. Gold, "Telecommunications Infrastructure and Economic Growth: An Analysis of Causality," *Telecommunications Policy*, vol. 15, No. 6, December 1991, pp. 529–535.

[26] As the authors note, "Studies have found that highly developed national economies are correlated with highly developed telecommunications infrastructure. In fact, the evolution of this research, employing state-of-the-art statistical techniques, has now confirmed the existence of a feedback process in which telecommunications investment enhances economic activity and growth, while economic activity and growth stimulate demands for telecommunications infrastructure investment. This relationship has been found, in general, to hold at the national, state and sub-state level of analysis and for definitions of telecommunications infrastructure investment including total investment, cable and wire and central office equipment." Francis J. Cronin, Elisabeth K. Colleran, Paul L. Herbert, and Steven Lewitzky, "Telecommunications and Growth," *Telecommunications Policy*, December 1993, vol. 17, p. 677.

[27] Total factor productivity refers to the changes in final output per unit of combined labor, capital, and material inputs.

[28] Cronin, et al., op.cit., footnote 26, p. 678.

[29] Ruby Roy Dholakia and Bari Harlam, "Telecommunications and Economic Development: Econometric Analysis of the U.S. Experience," *Telecommunications Policy*, vol. 18. No. 6, August 1994, pp. 470–477.

[30] In his 1984 study, Leff pointed out four significant relationships: 1) lower communication costs serve to reduce resource allocation decision costs between rural and urban sectors: 2) with lower communication costs, the optimal amount of search rises increasing the quantity and quality of decisionmaking; 3) by increasing the opportunities for arbitrage, lower communication costs make financial markets more efficient, resulting in lower capital costs; and 4) lower communication costs lead to more information on the probability distribution of prices, and permit the transformation of uncertainty into risk. See Nathaniel H. Leff, "Externalities, Information Costs, and Social Benefit-Cost Analysis for Economic Development: An Example from Telecommunications," *Economic Development and Cultural Change*, vol. 32, January 1984, pp. 255–276.

[31] Seth W. Norton, "Transaction Costs, Telecommunications, and the Microeconomics of Macroeconomic Growth," *Economic Development and Cultural Change*, vol. 41, October 1992, pp. 175–196.

THE CONTEXT IN DEVELOPING COUNTRIES TODAY

Both the historical and the statistical data relating telecommunication to economic and political development are drawn almost exclusively from experiences in Western countries, which share a common historical and institutional frame of reference. Many of these commonalities are absent in developing countries today. Thus, to anticipate how communication technologies will affect political and economic development in Third World countries, one cannot simply transpose the lessons from the past. As has always been the case, the impact of today's technologies will depend to a considerable degree on the specific social, economic, and political context in which they evolve.

The development challenges facing Third World countries today are monumental. Unlike the countries of Western Europe, developing countries do not have the luxury of executing the processes of nation-building, economic growth, and democracy in a sequential fashion, spread out over centuries (see box 3-5). Instead, these three processes must be carried out simultaneously, even though they are not always mutually reinforcing.[32] Compounding their problems, developing countries must deal with these challenges in an open, and increasingly networked, global economy. To be successful in such an environment, they must become further integrated into the world economy. Yet being more open, these countries run the risk that international players, with agendas of their own, could undermine their efforts at nation-building by competing for economic resources as well as political loyalties.[33]

Deteriorating social and economic conditions in many Third World countries magnify their problems. Over the past three decades, income disparity across the globe has doubled. Now, the richest 20 percent of the world's population receives an income that is 150 times the amount received by the poorest 20 percent.[34] Nearly 35 percent of the world's adult population is, moreover, illiterate. In addition, infant mortality rates continue to hover at 114 deaths per 1,000 live births.[35]

Third World resources to meet these challenges are severely limited, especially in the least developed countries.[36] Having yet to recover

BOX 3-5: The Development of Markets in Western Europe

Without markets, economic growth cannot take place. In Western Europe, it took 300 years for markets to become firmly established. And their emergence required no less than the consolidation of political authority; the secularization of society; the establishment of property rights that were free from feudal obligations; and the division of society into groups and rankings that, while based on economic interest, permitted social mobility. Today, developing countries are attempting to do in a few years what it took the ruling powers of Europe three centuries to accomplish.

SOURCE: Office of Technology Assessment, 1995.

[32] Thus, for example, democracy and political stability are not, as has generally been believed, highly correlated. Statistical evidence shows that, in becoming mature democracies, countries experience a difficult transition period when mass politics tends to exacerbate nationalism and national aggression. See Edward D. Mansfield and Jack Snyder, "Democratization and War," *Foreign Affairs*, vol. 74, No. 3, pp. 79–80.

[33] For a discussion of the relationship between local political participation and globalization, and its effect on the nation state, see Zdranko Mlinar, "Local Response to Global Change," *Annals of the American Academy of Political Science*, July 1995, No. 540, pp. 145–156.

[34] *Human Development Report 1993* (New York, NY: United Nations Development Program, 1993), p. 11.

[35] Ibid., pp. 11–12.

[36] The World Bank defines these "low income country" as those with a gross domestic per capita income of less than U.S. $635.

from the debt crisis of the 1980s, many countries continue to experience low growth rates, with the average for all developing countries ranging between 1.4 and 1.6 percent.[37]

In the area of sub-Saharan Africa—where these problems are the gravest—only marginal improvements in per capita income and consumption are anticipated, even under the most positive growth scenarios.[38] Assuming a less favorable global economic environment, a number of Latin American countries will probably also experience difficult times. Continued unrest in the Soviet Union and Eastern Europe would make economic growth in this region problematic as well (see table 3-2).[39]

The short term steps that many developing countries are taking to relieve their immediate social and economic problems could complicate, or even jeopardize, their prospects for long term sustainability. For example, in some cases, there has been excessive cropping, grazing, and timbering in areas that are already extremely fragile from an ecological standpoint (see table 3-3).

Population growth and per capita income growth will put new strains on the global environment. In 1960, the world's population was about 3 billion. The world population today stands at 5.3 billion and—according to a midrange forecast—it could increase by 70 percent to roughly 9 billion by 2030. Moreover, if global per capita incomes increase at an estimated rate of 80 percent, world economic output could grow to as much as $69 trillion by 2030, 3.5 times more than at present.[40] If pollution

TABLE 3-2: Developing Regions: Growth of Real GDP
(percentage changes per year)

Developing region	Trend 1974–90	Recent estimates 1991–93	1994–2003 Forecast	1994–2003 Low case
All developing countries	3.4	0.9	4.8	3.6
Sub-Saharan Africa	2.1	1.7	3.9	2.4
Middle East and North Africa	0.9	3.0	3.8	3.2
Europe and Central Asia (ECA)	3.1	-9.8	2.7	1.5
South Asia	5.0	3.5	5.3	4.2
East Asia	7.3	8.3	7.6	7.1
Latin America and the Caribbean	2.5	3.2	3.4	0.8
Memorandum item				
All developing countries, excluding ECA	3.5	4.6	5.2	4.0

SOURCE: *Global Economic Prospects and the Developing Countries*, A World Bank Book, 1994.

[37] *The Least Developed Countries Report* (Geneva, Switzerland: UNCTAD, 1995).
[38] *Global Economic Prospects and the Developing Countries* (Washington DC: World Bank, 1994), pp. 1–7.
[39] Ibid.
[40] Developing countries per capita incomes are estimated to grow by 140 percent. Calculated from data contained in World Bank, World Development Report, 1992 (Washington, DC: World Bank, 1993).

TABLE 3-3: Estimates of Environmental Damage in Selected Countries

Country and Year	Form of Environmental Damage	Annual Costs as a Share of GNP (percent)
Burkina Faso (1988)	Crop, livestock, and fuelwood losses from land degradation	8.8
Costa Rica (1989)	Deforestation	7.7
Ethiopia (1983)	Effects of deforestation on the supply of fuelwood and crop output	6.0–9.0
Germany (1990)[1]	Pollution damage (air, water, soil pollution, loss of biodiversity)	1.7–4.2
Hungary (late eighties)	Pollution damage (mostly air pollution)	5.0
Indonesia (1984)	Soil erosion and deforestation	4.0
Madagascar (1988)	Land burning and erosion	5.0–15.0
Malawi (1988)	Lost crop production from soil erosion Costs of deforestation	1.6–10.9 1.2–4.4
Mali (1988)	On-site soil erosion and losses	0.4
Netherlands (1986)	Some pollution damage	0.5–0.8
Nigeria (1989)	Soil degradation, deforestation, water pollution, other erosion	17.4
Poland (1987)	Pollution damage	4.4–7.7
United States[2] (1981) (1985)	Air pollution control Water pollution control	0.8–2.1 0.4

1 Federal Republic of Germany before unification.
2 Measures the benefits of environmental policy (avoided rather than actual damages).

SOURCE: "Environmental Damage Robs Countries' Income," *World Bank News*, March 25, 1993, based on David Pearce and Jeremy Warford, *World Without End* (Washington, DC: World Bank, 1993)

keeps pace with this projected development, the environmental damage could be astronomical.

The problems facing developing countries are inextricably linked to one another, as the case of population control clearly illustrates. Most population studies now show, for example, that pregnancy decisions in Third World countries are both determined by, and have an impact on, a number of other interrelated social, economic, and environmental factors. For example, the correlation between fertility rates and education is particularly strong.[41] According to the World Bank, women in developing countries who have no secondary education generally bear up to seven children. In contrast, those who have attended secondary school average only three births.

Levels of education as they affect birth rates are related, in turn, to the health of both women and children. In developing countries, pregnancy is the primary cause of death for women of childbearing age. In fact, in some parts of sub-Saharan Africa, it is not unusual to find one maternal death per 50 live births.[42] Of equal note, when mothers are educated and have fewer children, they provide better care for their children, whose health and prospects of survival are greatly enhanced as a result. In addition, girls born in such families are more likely to be educated and

[41] "Battle of the Bulge," *The Economist*, vol. No. 7879, Sept. 3, 1994, p. 23.
[42] Partha S. Dasgupta, op. cit., footnote 41, pp. 42–45.

thus less likely to marry early, have multiple pregnancies, and repeat the cycle.[43]

Some form of intervention is needed if developing countries are to extricate themselves from these downward spirals of deterioration. Overwhelmed by short-term problems of immediate survival, most Third World countries have, unfortunately, only limited resources to invest in altering their futures. Thus, notwithstanding recent improvements in infrastructure for transport, power, water, sanitation, telecommunications, and irrigation, there are today more than one billion people in the developing world who lack access to clean water, and nearly two billion without adequate sanitation.[44]

One ray of hope is the recent economic progress made by a number of Third World countries. Unlike most developing countries, which continue to be mired in civil conflicts, political instability, and economic decline, 12 countries have improved their economic performance during the first half of the 1990s, with significant increases in per capita output.[45] Included are Bangladesh, Benin, Cambodia, Equatorial Guinea, Guinea-Bissau, the Lao People's Democratic Republic, Lesotho, Mozambique, Myanmar, Sao Tome and Principe, the Solomon Islands, and Sudan.[46]

As was the case with the "newly industrializing countries" a decade earlier, the success of these 12 can be attributed, in part, to their ability to maintain internal stability while reaching outward to the global economy. If other less developed countries are to be similarly successful, they too must gain the inner capacity that will give them the flexibility to adapt to the structural changes taking place in their external environment. Most important, they must—as described below—be prepared to compete in a global knowledge-based economy, where production takes place on a worldwide, but decentralized and flexible, basis. The first countries to adapt to these changes will gain a significant competitive advantage, while countries failing to do so will fall behind.

LEVERAGING COMMUNICATION TECHNOLOGIES

Communication and information technologies, as they are advancing today, can make a critical difference in determining Third World success or failure. Ideally, these technologies can serve both to foster economic development, democracy, and political stability and to balance these processes, so as to make them more mutually reinforcing. These technologies can, moreover, make it easier for developing countries to reinforce national and local community ties while at the same time fostering their global integration.

Technology Trends

Present advances in communication and information technologies can best be summarized in terms of the following seven trends. It is these trends that are altering the technical characteristics and capabilities of the infrastructure in Third World countries, and changing the manner in which communication processes will likely be carried out.

Greatly Improved Performance at Decreasing Costs

The technical performance of all network components has greatly increased at the same time that the costs have fallen. This, more than any other development, will have a pervasive impact on the communication infrastructure. Many of these improvements result from advances in computer technologies which are increasingly ubiquitous throughout all communication systems.

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[43] Ibid.

[44] *World Development Report 1994, Infrastructure for Development* (Washington DC: World Bank, 1994), p. 1.

[45] *The Least Developed Countries Report*, op. cit., footnote 37. Viewing the situation more pessimistically, some OTA reviewers point out that continued progress in these 12 countries is by no means a foregone conclusion.

[46] Ibid.

Advances in computer architecture and software have also helped to harness the processing power in communication applications. In the past, switching mechanisms were used to replicate the manual operations entailed in placing a telephone call. The development of common channel signaling and intelligent databases now permits network switches to operate as computers, making real-time routing decisions based on the status of the network, call loads, and the characteristics of callers. With new developments in fast packet switching technologies, such as frame relay and asynchronous transfer mode (ATM), these kinds of intelligent network operations can be executed with much greater flexibility and increasing speeds.

Advances in transmission technologies are keeping pace with, if not exceeding, those in switching. Developments in fiber optics, which provide an excellent medium for transmission, have been most significant. With minimum transmission loss, fiber allows many more signals to travel over longer distances with smaller numbers of repeaters than does copper wire. Thus, it can support new broadband applications such as video telephony, multimedia services, and very high speed data services.

The capabilities of lightwave transmission, for example, are doubling every year, a trend that is likely to continue for another decade. Already, commercial systems have been developed that transmit 2.4 gigabits (billion bits) per second. Within the next few years, the use of laser systems and wavelength division multiplexing on a single fiber will permit the transport of multiple channels of information yielding a capacity of 40 gigabits per second.[47] These gains in capacity have, moreover, been matched by a decline in price. At present, the price per unit of transmission for fiber optics has been dropping at a rate of 40 percent per year.[48]

Network performance has also been improved through the use of digital compression technology, which reduces capacity requirements by selectively eliminating redundant data.[49] When used together with advanced switching technologies, digital compression can greatly enhance the capacity of existing copper-based networks. Thus, for example, it is now possible to transmit data at speeds of 10 megabits using twisted pair wire. Moreover, researchers claim that, by compressing signals in the channel rather than at their source, copper telephone wire can be upgraded to achieve the capacity of fiber, thus greatly reducing the need for infrastructure investment.[50]

Major strides are also being made in video compression, which requires considerably more bandwidth than data and voice.[51] With compression technology, for example, it is now possible to fit multiple video signals into a satellite transponder or a 6 MHz cable channel—an amount of space that previously could only accommodate an analog signal.[52]

Digital compression has also facilitated advances in storage technologies (see figure 3-2). Consider, for example, CD ROM—the cheapest

[47] David Brody, "Internet@Crossroads $$$," *Technology Review*, May/June 1995, p. 28. With wave division multiplexing, each fiber optic cable can accommodate multiple channels by assigning each data stream a different wave length or color.

[48] Michael J. Mandel, "This Investment Book Gives the Economy Running Room," *Business Week*, July 25, 1994, pp. 68–70.

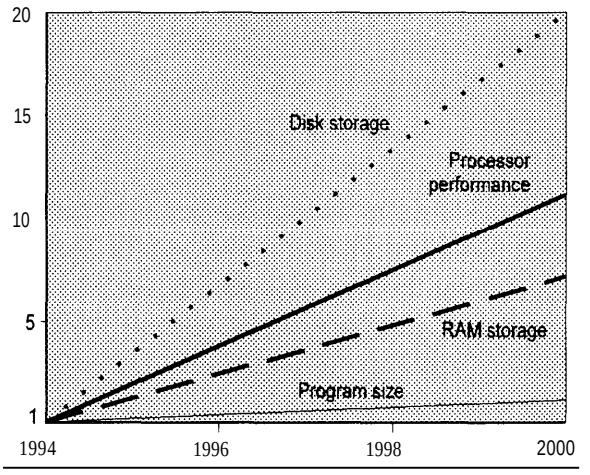
[49] In the case of audio, for example, a compression algorithm will eliminate that portion of the information that the human sensory system would typically select out before a message reaches the brain. See Mary Ann O'Connor, "The Latest in Compression Technology," *CD-ROM Professional*, January 1994, p. 153.

[50] Paula Bernier, "Compression Helps Copper Equal Fiber," *Telephony*, Jan. 31, 1994, pp. 9–10.

[51] As opposed to the 64-kb/s streams that are typically used for voice telephone to the home, video signals require approximately 140 Mb/s of bandwidth. With digital compression, signals can be compressed to about 1.5 Mb/s for videocassette recorder-quality movies, and to about 12 MB/s for real-time compressed video. See Richard Karpinski, "Video Dial Tone: Putting the Pieces Together," *Telephony*, July 25, 1994.

[52] Richard A. Langhans, "A Beginner's Guide to Digital Compression," *Satellite Communication*, November 1994, p. 24.

FIGURE 3-2: Projected Improvement Factors in Computing



SOURCE: *IEEE Spectrum,* January 1995.

storage media available today.[53] Using existing technology, the entire *Encyclopedia Britannica* and the complete works of Charles Dickens can now be stored on a single disk. Electronics companies are, however, working on a standard—High-Density CD ROM—that will increase CD-ROM storage capacity by an order of magnitude to *6.7* gigabits.[54] These high-capacity CD-ROMS can be used to distribute interactive video, much as audio CD-ROMs are presently being used.[55]

The Convergence of Communication Functions, Media, and Services

Technology advances over the last decade have also led to the convergence of communications functions and media. For example, data processing and telecommunications were once clearly distinct sets of operations, carried out by quite different economic actors. This is no longer the case. Digital switching and data processing now serve as the centerpieces of modern communication networks. With the deployment of fast packet switching and the integration of further intelligence into communication networks, it has become increasingly difficult to distinguish between the functions of switching and transmission.

One major technology advance contributing to this trend is digitization-the process of transforming "analog" messages (a spoken work, a picture, a letter) into signals made up of discrete pulses that can be transmitted, processed, and stored electronically. When in a digital form, audio, video and textual messages can be combined and recombined, allowing information to be integrated in a way that was previously impossible.[56]

In the case of telephony, digitization was first introduced in the short-haul exchange of the telephone network in the early 1960s, and into the long-haul sectors and local exchange markets in the 1970s. With the development of digital loop technologies providing digital connectivity to the customer, it became possible to offer digital data services. Transmitting digital data is much more efficient than transmitting analog data because the data do not have to be converted into tones simulating voice signal. Improvements in the performance and reliability of digital technologies, together with a reduction in their size and cost, have also fostered these developments.

The development of lightwave technology also spurred the trend towards convergence. Given the generous bandwidths provided by fiber optics, telecommunication providers were no longer technically precluded from transmitting high-speed digital images.

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[53] Alan J Ryan, "It's All in the Disc," *Datamation*, vol. 41, No. 3, Feb. 15,1995, pp. 61–62. See also, Barry Fox, "CDs: The 'e' Generation," *New Scientist,* Sept. 10, 1994, pp. 33–35; and Stephanie Losee, "Watch Out for the CD-ROM Hype," *Fortune,* Sept. 19, 1994, pp. 127-140.

[54] Michale Nadeau, *CD-ROM World,* vol. 10, No.1, January 1995, p.10.

[55] Nancy K. Herther, "CD-ROM at Ten," *Online,* March/April 1995, pp. 86–93.

[56] As described by Steward Brand, "With digitalization all of the media becomes translatable into each other—computer bits migrate merrily-and they escape from their traditional means of transmission....with digitalization the content become totally plastic-any message, sound, or image may be edited from anything into anything else." Steward Brand, *The Media Lab: Investing the Future at MIT (New* York, NY: Penguin Books, 1988), p. 19.

Epitomizing this trend towards convergence are broadband networks. Based on a common set of standards, these networks are designed to provide efficient interconnection for all possible communication services. Because they do not require separate systems for voice, data, and video, such networks are truly integrated. To provide broadband capacity, networks take full advantage of digitization, advanced switching, and lightwave technology.

The effects of digitization are being experienced far beyond the realm of telecommunications. For example, providing the ability to integrate and process voice, video, and text, digitization is giving rise to a wide range of multimedia applications that are designed to run on networked technologies.[57] Today, for example, voice, fax, and visual data can all be provided interchangeably on the desktop, so that information accessed from a database can be seen as well as heard. Multimedia software programs can be used to enhance all types of computer applications—business, education, and entertainment alike—with sounds, brilliant images, and outstanding animation.

Decentralization of Intelligence Throughout Communication Systems

The greatly improved performance of computer technologies and their convergence with communication technologies have facilitated the dispersal of intelligence and control throughout communication systems. More and more, systems are becoming defined and driven by software, which provides network structure and functionality, determining such critical features as interconnection, interoperability, and ease of use. Software-defined communication facilities are not only more flexible and versatile, they empower users, giving them greater control over network access, configuration and use.

This dispersal of intelligence throughout communication systems is well illustrated in the intelligent network (see box 3-6). The first computer-controlled switching systems were deployed 20 years ago. In the 1970s, when advances in integrated circuit technology permitted the creation of a solid-state exchange, telecommunication providers began to deploy digital switches. With the deployment of even more powerful microprocessors, faster computing speeds, and larger memories, it became possible to locate intelligence not just in the central office switch, but also at nodes throughout the network. Because these "intelligent" nodes can communicate in real time with one another, as well as with other networks, communication based on this kind of architecture offers greater flexibility—they can respond to network problems and to changes in user demand, optimize network capacity, and ensure greater system and service reliability. Moreover, because software databases and intelligent switches can be accessed and modified by customers as well as by service providers, the integration of intelligence into the network allows users greater control over the provisioning of their services.

Intelligence can also be delivered directly to users with hand-held personal computers or at the desktop. Personal digital assistants (PDAs), for example, can now be programmed to execute tasks on the user's behalf. With PDAs connected to intelligent wireless networks, users can instruct an agent on the network to contact them on receipt of a message. In turn, messages can be instructed according to their content to be immediately responded to; to be forwarded to a fax or personal computer; or otherwise dispensed with.[58] Similarly, with fax on demand, callers can dial a telephone, listen to a voice menu describing the various documents they can receive by fax, and opt either to receive the fax at a specified location

[57] Multimedia refers to the ability to combine text, high-quality graphics, sound, animation, photo images, and video into a single interactive presentation in conjunction with networked computer technology. See Joseph C. Otto, "Multimedia—What is It?" *Business Forum,* summer/fall 1994, pp. 8–9.

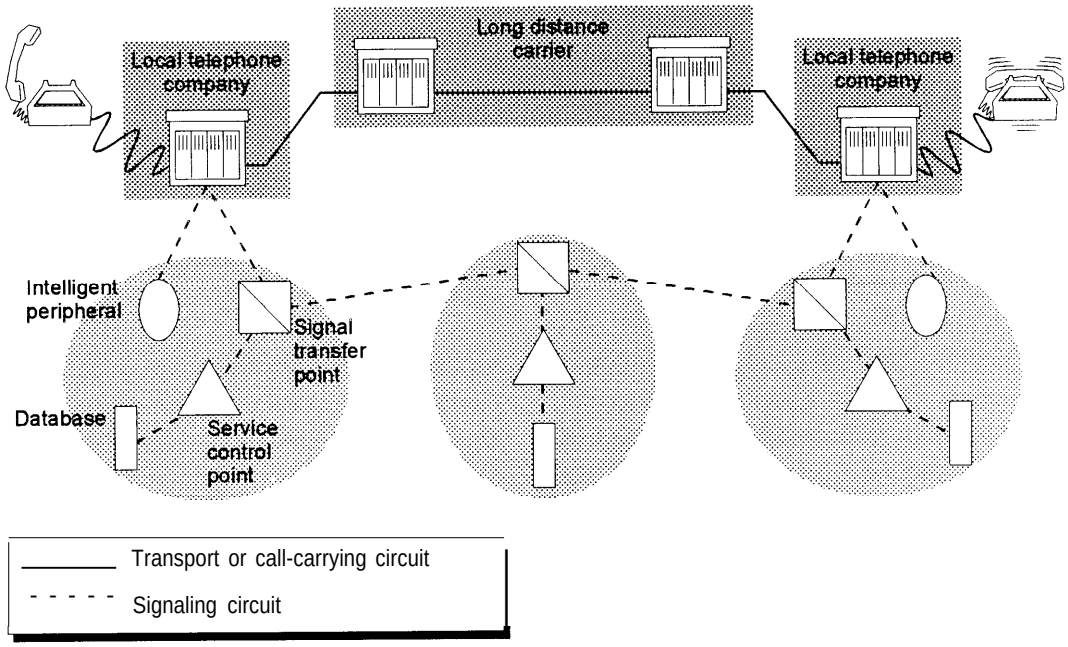
[58] Robin Gareiss, A Value Added Service With Brains," *Data Communications,* January 1995, pp. 66–70.

BOX 3-6: The Intelligent Network

The advanced intelligent network, elements of which are currently installed in today's public switched telephone network, envisions greatly increased operating efficiency as well as a broad array of sophisticated network services by separating the call transport (i.e., the voice circuit) function from the signaling and control function and employing the powerful software in the switches.

Imagine, for example, an instance where a caller places a call to a family member who, while on vacation, has indicated that calls from certain numbers are to be rerouted to the new location and given a unique ring to indicate priority. In this illustration, the vacationer would have preprogrammed the priority telephone numbers (other calls might be routed to an answering service or machine) and the new destination number by dialing into the intelligent peripheral and inputting these data. When the caller dials the number, the local switch queries the signal transfer point for billing and accounting information. It also ascertains from the service control point a clear path through the local network to the point of presence of the caller's long-distance carrier of choice. The signaling networks of the two local exchange companies and the long distance carrier interact to learn the status of the called party and, thus, how to set the call up; in this case, the call has been redirected to a telephone address in a new location, so a third local company is involved and once again the status of the called party is learned (for example, if the line was in use, the network would direct local carrier A to transmit a busy signal to the caller) and establishes a calling path. Local carrier C is also instructed to deliver the special ring.

SOURCE: Office of Technology Assessment, 1995.



or have it automatically transmitted, perhaps to a PC, as an editable document.[59]

Intelligence is also increasingly being incorporated into home-based customer equipment. Consumers can now, for example, program their telephones, their home security systems, and their VCRs, while at the same time interacting with their televisions.

Unbundling of Communication Services and Functions

Unbundling refers to the ability to separately purchase communication services or functions that were formerly available only as a single unit. Linked to the trends of convergence and decentralized intelligence, this phenomenon is becoming increasingly prevalent in all communication systems.

Unbundling first appeared in telecommunications with the Carterfone decision of 1968,[60] which allowed customers to add equipment to their telephones as long as they did not adversely affect the operation of the telephone system or its usefulness to others. A clarification of this decision by the Federal Communication Commission (FCC) in December 1988 extended its provisions to microwave systems and computers. The Carterfone decision ruptured the well-established arrangement whereby AT&T was assigned the responsibility of providing national end-to-end telephone service. Applied broadly, these decisions encouraged the entry of new entrepreneurs who wanted to plug into the network with new kinds of customer-premise equipment, or enhance the value of their private systems by interconnecting with the public network.[61] Thus, they cleared the way for the development of entirely new communication industries. Today, the unbundling of the communication infrastructure is clearly demonstrated by the emergence of a whole range of competing communication equipment and service providers.

Unbundling has also occurred in the computer and computer networking environment. With greater standardization and advances in interconnection devices such as routers, bridges, and intelligent hubs, computer networks can be more easily interconnected into larger networks. Most computing functions, moreover, are no longer hard wired into systems themselves but rather are rendered in software, which is available in a number of different varieties. And, with developments in applications program interfaces (APIs), different software programs are increasingly portable from one computing system to the next.

Increased Portability

Miniaturization and the ability to unbundle intelligent equipment from the communication infrastructure are also increasing the portability of communication products and services as well as the mobility of users. Employing portable equipment, such as pagers and cellular telephones, users can communicate from any geographic location. These technologies serve a number of niche applications, such as taxi dispatching, mail tracking, and point-of-sale. Many are now outfitted to handle data and fax transmission as well as voice.

Although all mobile technologies are based on cellular architecture, they differ with respect to the types of services that they can provide (see box 3-7). Paging devices and networks operate, for example, on a receive-only basis. Although palmtop computers have CPUs with limited memories, they can run a wide variety of applications, such as calendars, schedules, and spread

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[59] Ron Levine, "Surprise! Fax Servers Smarten Up," *Datamation*, May 15, 1995, p. 63.

[60] The Carterfone was a device that permitted callers to use the telephone network to communicate directly with others located at remote mobile radio terminals. It was not the first telephone attachment to be developed outside of the Bell System. As Alan Stone has pointed out, there have always been inventors developing attachments that could supplement or even substitute for Bell equipment. However, both AT&T and state regulatory authorities strongly opposed the use of such components, viewing them as inimical to the well-established requirement that AT&T provide end-to-end service. For a discussion, see Alan Stone, *Wrong Number: The Break Up of AT&T* (New York, NY: Basic Books, Inc., 1989), pp. 87–90.

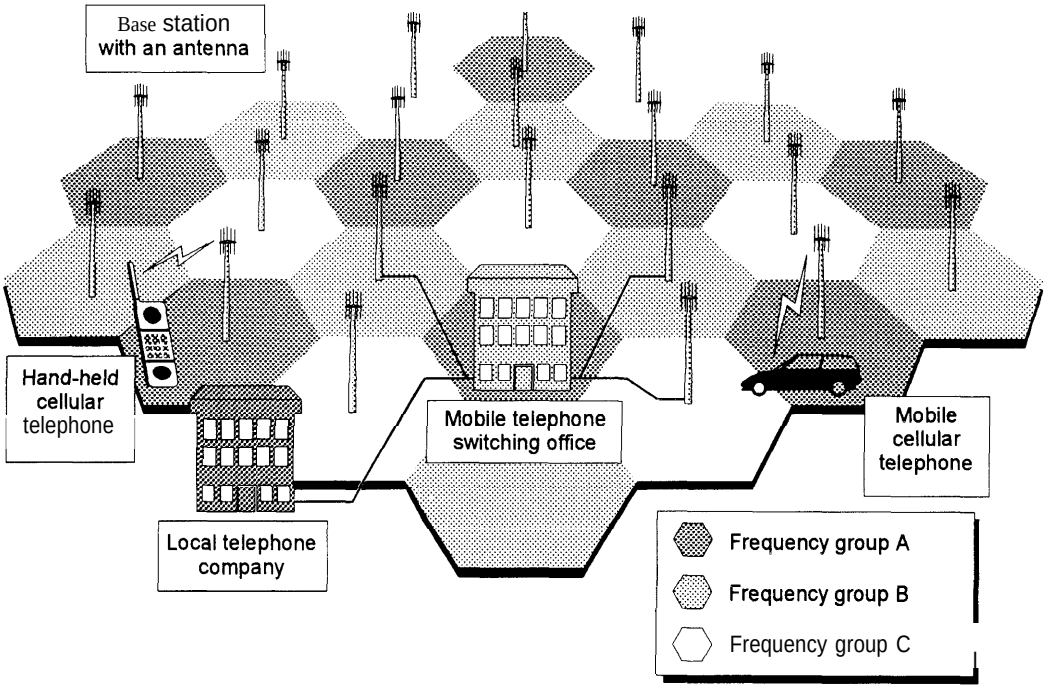
[61] To sort out this issue, the FCC undertook a series of computer inquiries called Computer Inquiry I, II, and III, none of which fully resolved this problem.

BOX 3-7: Cellular System Architecture

Modern terrestrial systems use a cellular architecture that provides coverage within many low-power transmitters. Each of the low-power transmitters in a cellular system provides coverage to an area a few miles, known as a cell (see figure). Cells are often drawn as circles or hexagons, but real-world cells are irregular in shape because buildings and trees obstruct the radio waves. By deploying enough transmitters or base *stations,* cellular operators provide continuous coverage wherever their customers are likely to be. Because users often pass through several cells as they travel through a city, a cellular system has to automatically *hand-off* the call from base station to base station. As the user nears the edge of a cell, the system reassigns the user to a new cell by determining which of the other base stations in the area can provide the strongest signal,

The cellular architecture makes efficient use of the spectrum and increases system capacity. In a conventional single-tower system, each channel can only be used by one customer at any one time. By contrast, a cellular system allows a channel used in one cell to be reused by a different user in another cell, as long as there is enough separation between cells to minimize interference. Network operators can further increase system capacity by splitting large cells into smaller ones, The greater the number of cells, the greater the number of users who can use a channel at the same time.

SOURCE: Office of Technology Assessment, 1995



sheets. Wireless local area networks (LANs) are limited in range, but when equipped with wireless interface cards and antennas, they can interconnect with mobile units or a fixed network. Wireless wide area networks (WANs) can provide wide area coverage for low bandwidth data services at a rate of 19.2 kbps.[62]

Improved Ease of Use

As technologies become more sophisticated and communication systems more complex, systems interfaces that make it easier for people to interact with technology in human terms are becoming increasingly important. Enhancements in computer-processing and storage technologies, for example, have led to the development of icon-based graphical user interfaces, such as are found in the Windows environment. Advances in speech processing and its integration into computer and communication systems are also playing an important role in making these technologies more accessible. By the turn of the century—given the present rate of progress in computerized analysis of natural languages, together with increased computing power—estimates are that it will be possible to recreate practical spoken conversation.

Equally important have been the development of search engines and navigational tools for sorting through the vast amounts of data that are increasingly available on-line. Most revolutionary in this regard have been the recently developed tools designed to browse the Internet, including for example, Gopher, Mosaic, and Netscape. Simply by pointing and clicking a mouse, users can conduct searches using key words from menus resembling tables of contents. Moreover, many navigation tools now allow users to organize and arrange vast amounts of information into clusters of related documents, as well as keep track of searches.[63]

Increased Networking Capability

Although seemingly paradoxical, the unbundling of the communication infrastructure, in conjunction with the distribution of intelligence throughout communication systems, has led to the simultaneous reintegration of communication systems through the process of computer networking. A computer network is a collection of computers that communicate with each other using common protocols. The computers may be personal computers, commonly used in homes and businesses, or they may be larger workstations, minicomputers, mainframes, or supercomputers. Transmission can be provided using coaxial cable, optical fiber, satellite links, twisted pair lines, or telephone lines. Connections between hosts can be limited to a local area (local area networks, or LANs), or they may provide long-haul connectivity (wide area networks, or WANs). Employing such systems, data in the form of text, voice, and video can, in principle, be stored, modified, and exchanged by anyone, anywhere in the world.

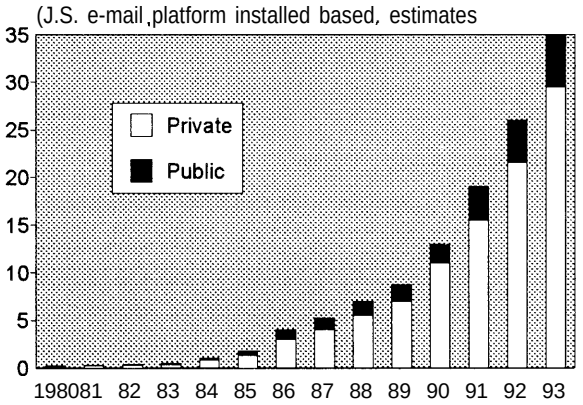
[62] Tomasz Imielenski and B. R. Badrinath, "Wireless Computing," *Communication of the ACM*, vol. 37, No. 10, October 1994, p. 18.

[63] "Searching With a 3-D Gopher," *The Internet Letter*, vol. 2, No. 8, May 1, 1995, p. 3; Greg R. Noless, "On the Nets," *Database*, December 1994, pp. 79–81; and "With InfoMagnet, Listserv Searches Are a Breeze," *The Internet Letter*, May 1, 1995, p. 4.

Computer networks offer a number of benefits. At a minimum, they can provide electronic mail (see figure 3-3). Increasingly, they are being used to link businesses together, supporting a wide range of applications such as remote processing, shared information systems, enterprise integration, groupware and electronic data interchange (box 3-8). With standardization of the technology and the integration of ATM switches into the network, broadband applications—such as high speed local area networks, desktop videoconferencing and video entertainment services will continue to evolve.[64]

Nothing attests to the benefits of networking more than the recent phenomenal growth of the Internet. The Internet is a global computer network that provides technical compatibility and transparent connectivity based on a widely used suite of protocols—TCP/IP (see box 3-9). It is currently made up of approximately 5,000 networks to which 500,000 computers are connected. Originally funded through Department of Defense's Advanced Research Projects Agency (ARPA), and later the National Science Foundation (NSF), to support defense communication and research, the Internet today is a worldwide communication network that provides a platform for the delivery of a wide range of services, a number of which are now being provided on a commercial basis.

FIGURE 3-3: Growth of Private and Public Electronic Mail Networks



SOURCE: Electronic Mail and Micro Systems, Jan. 1, 1994, pp. 1-10

The Impact of Technology Advances

Table 3-4 lays out the interrelationship between today's technology advances and the social and economic changes likely to take place in developing countries. Column 1 summarizes the technological trends (listed above) and the technological developments reinforcing them; column 2 lays out the technological implications of, and the new applications that result from, these trends; while column 3 identifies their social, economic, and political impacts.

In examining this table, it is important to note that it is the new capabilities and applications that advanced technologies make possible that give rise to social, economic and political impacts, and not the technologies or the trends themselves. Secondly, it is necessary to keep in mind that technologies are not neutral with respect to their impacts and outcomes. Different trends give rise to different kinds of impacts, all of which must be taken into account.

64 Asynchronous transfer mode (ATM) is a high. speed virtual circuit oriented cell-switching technology that provides communication at speeds between 45 and 155 Mbps. ATM can support different kinds of services such as voice, data, image, video and multimedia, including real-time information, over a single network. Using ATM, networks are easier to run, more reliable, and more flexible. See for discussions, Jonathan Reeves, "Low-Speed Access: Extending the Reach of ATM," *Telecommunications*, February 1995, pp. 23–29; Harry Flinsenberg, "Broadband Network Evolution," *Telecommunications* February 1995, pp. 32–37; Alwyne Sinclair, "ATM: Today's Network Solution," *Telecommunications*, October 1994, pp. 83–84; and James J. Lane, "Is ATM a Miracle or Another Terrible Mistake," *Telephony*, Oct. 24, 1994, p. 28.

TABLE 3-4: Impact of Technology Advances

Technology Trends	Technology Capabilities and Applications	Social, Economic, and Political Impacts
Increased performance at greatly reduced cost — e.g., microelectronics, fiber optics, voice and video compression, fast-packet switching, very high-density storage technology	Permits LDCs to leapfrog to advanced technology; maximizes advantage of existing technology. Technologies also provide greater geographical coverage.	National political/economic integration; more efficient markets and more effective political control and administration, Potential for the erosion of national boundaries due to reinforcement of global ties — e.g., PeaceNet, EcoNet, etc.
Technology convergence due to digitization, wideband transmission, compression technologies, and standards developments	Cost efficiencies in service due to economies of scale and scope and greater networking versatility. Greatly enhanced applications, such as real-time video transmission, videoconferencing and multimedia applications for the home, the desktop, or (less expensively) public point-of-sale terminals.	Greater support for the low-cost provision of public services such as health care and education Multimedia is especially useful in LDCs given high illiteracy rates. Supports business applications, such as computer-aided design, desktop fax, videoconferencing.
Unbundling of communication functions and services due to the emergence of competing technologies, the dispersal of intelligence throughout communication networks, the demand of large users, and deregulatory communication policies.	Permits users to separately purchase communication functions and services Allows for greater flexibility in network design and architecture More networking, options and freedom to customize networks to minimize costs or to match specific needs, Lower costs also due to greater competition among vendors and service providers interoperability, network integration, and network management likely to require greater technology expertise.	Democratic process likely to benefit from greater diversity of communication sources and network designs. Allows developing countries to manufacture low-end components and gain technology expertise. Less elaborate and expensive systems may provide more “appropriate” technology to meet developing country needs. On the other hand, problems of interoperability and increased complexity can create new information bottlenecks with consequences for politics and the economy. Technology experts and system integrators become new information gatekeepers.
Increased ease of use as a result of advances in storage, microelectronics, speech recognition, and search engines. Applications include simple-to-use graphic user interfaces (such as Windows), network browsers (such as Netscape), and intelligent agents,	Supports greater network access and usage, promotes deployment, and reduces the level of expertise required to take advantage of information technologies.	Reduces access barriers with positive benefits for both competitive markets and democratic politics,

TABLE 3-4: Impact of Technology Advances (Cont'd.)

Technology Trends	Technology Capabilities and Applications	Social, Economic, and Political Impacts
Decentralized intelligence throughout communications systems due to software-driven and software-defined communication networks	Provides for two-way interaction and greater user control. Applications include interactive television, personal digital assistants, desktop publishing, intelligent networks, and expert systems. Provide a platform for creating value-added services, such as 800 number, point of sale, credit authorization,	In most LDCs, two-way, interactive media can support local grass-roots participation, thereby enhancing democratic processes Provides an opportunity to develop specialized or local content to reinforce community ties. Value-added services provide or substitute for a lack of an information infrastructure (banks, insurance, legal
Increased networking capabilities due in part to advances in integration and switching technologies such as routers, intelligent hubs, and asynchronous transfer mode (ATM), frame relay, together with advances in wideband transmission technologies such as SON ET, and software support applications such as CAD-CAM, EDI, groupware, as well as the development of standards and networking protocols such as TCT/IP and application programming interfaces.	Supports distributed client-server computing and cooperative work applications such as e-mail, E D 1, computer-integrated manufacturing, teleworking and groupware. Provides support for the development of specialized functional networks, such as financial services networks or special interest group networks such as EcoNet.	Supports democratic politics by helping individuals locate information, identify like-minded people, deliberate, and voice opinions Networks help businesses and firms reduce their costs by integrating processes and information, and to gain a strategic advantage by developing exclusive networks that lock in customers and suppliers Without access to advanced networking technologies, developing countries may become locked out.
Increased mobility and portability due to distributed intelligence and advances in wireless technologies such as satellite/VSAT, cellular telephony, PCS, radio paging, digital radio, and wireless LANs, WANs, and PBXs	Low-cost alternative to wireline technologies for use in difficult-to-reach, high cost areas Greater ease and speed of deployment. Allows for greater network flexibility and support for remote information access and processing. Applications include wireless networks based on a mesh rather than hub architecture When combined with unbundled, intelligent peripherals, wireless networks support the widespread distribution of information and '(intelligence" to all areas. Applications include CD-ROM libraries or expert health care systems	Facilitates open markets and democratic politics by supporting access to political and economic information and communication networks as well as to expertise and "intelligence" from and to anywhere. Facilitates network configuration and shared information systems, which support the competence of local governments, and reinforces community ties.

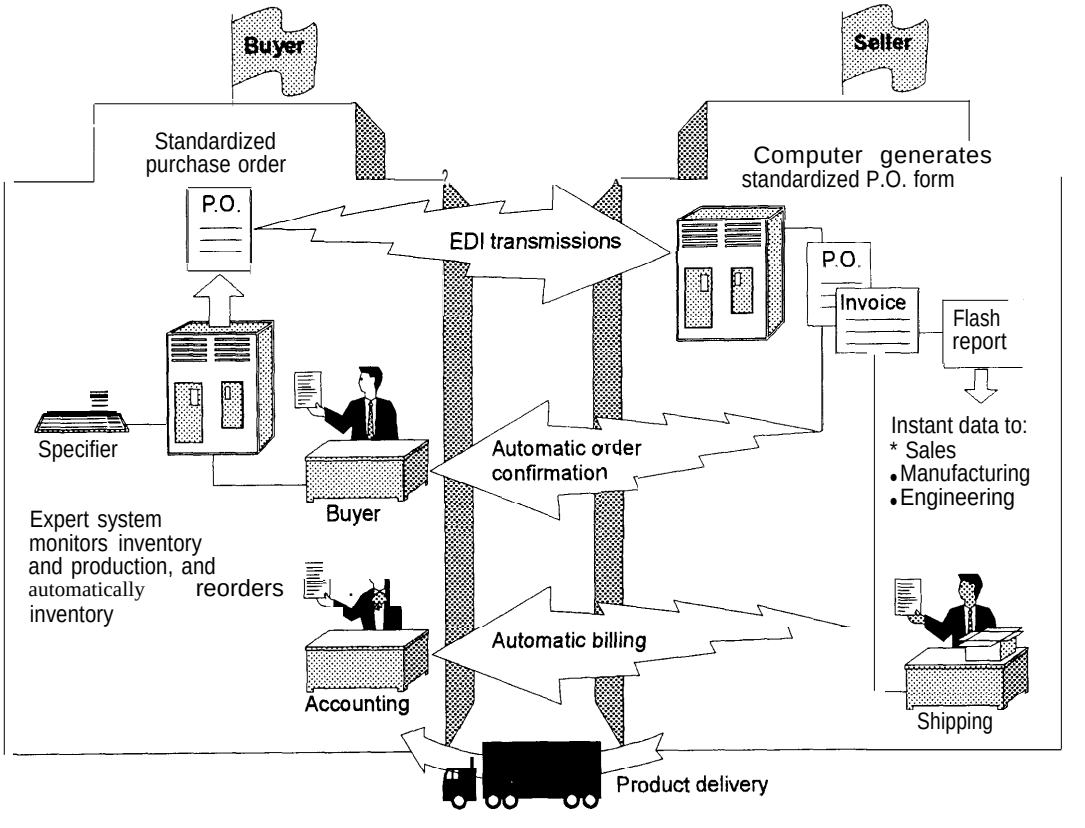
SOURCE: Office of Technology Assessment, 1995.

BOX 3-8: Electronic Data Interchange (EDI

Electronic data interchange (EDI) is a notable example of how information and communication technologies are emerging as important strategic tools for efficient and effective business operations. EDI is essentially the modern, computer-based method by which companies order, invoice, and bill their products and services. Such common transaction functions as invoices, shipping notices, and bills, which traditionally have entailed the transfer and processing of paper documents, are replaced by electronic transfers between the business computers (see figure).

EDI improves the efficiency and effectiveness of operations by enabling businesses to purchase supplies and to produce and distribute products precisely when and where they are needed. The company's computer system, for example, will initiate a purchase order and execute the purchasing transaction when an item is requested and removed from the inventory. The price, terms, and conditions of the contract are all stored in the computer. In addition to the considerable savings gained as inventory costs are reduced, EDI also minimizes human clerical error and the considerable processing costs involved with paper transactions. By reducing or eliminating the prolonged and often error-plagued paper trail, large retailers and manufacturers are able to gain a competitive advantage by streamlining transactions with their suppliers and buyers.

SOURCE: Office of Technology Assessment, 1995.



BOX 3-9: The Internet

The Internet is the largest network of computer networks in the world. It is a three-level hierarchy consisting of backbone networks that may span thousands of miles, regional or mid-level networks, and local area networks belonging to government agencies, universities, businesses or organizations. The Internet is unique for its ability to support a wide variety of applications and for the impact that these applications will have in the industrialized and developing world.

The Internet dates back to 1969 when ARPAnet, a pioneering longhaul network funded by the U.S. Department of Defense's Advanced Research Projects Agency (ARPA), became operational. The impetus for ARPAnet's creation was the desire for a computer network that would remain operational in the event that part of the network was destroyed by a nuclear explosion. The ARPAnet therefore had no central control center. Rather, each node on the network was equally capable of sending and receiving packets of data throughout the network.

A breakthrough in the achievement of such resilient packet switched networking was the development of transmission control protocol/internet protocol (TCP/IP). A *protocol* is a set of formal rules describing how to transmit data across a network. TCP, or "transmission control protocol," converts messages into streams of packets at their source and then reassembles the packets into messages at their destination. IP, or "Internet Protocol," makes sure that packets are routed to their proper destination.

Included among the TCP/IP protocol suite are a number of tools that allow users of networks with TCP/IP capability to send electronic mail to other users, participate in discussion groups, carry out distance computing, and locate and retrieve text, data, software and other information available for public access. Special computers on TCP/IP networks called "servers" or "hosts" facilitate these applications by responding automatically to queries from other servers or from personal computers that are linked to the network. TCP/IP networks will also support video transmission and, more recently, real-time voice traffic.[1] Access to an "Internet server," sometimes called a "point of presence," is the key to the applications mentioned above.

Surprisingly, the Internet is not technology specific. Networks that make up the Internet incorporate communication technologies as diverse as traditional twisted pair copper telephone lines and the latest short-haul laser transmission technologies. Satellites and undersea fiber optic cables are used to link networks separated by large land areas or by oceans.

The Internet has doubled in size every year since 1988, and analysts estimate that as many as 30 million people in 90 countries worldwide have full Internet access, that is, are linked to networks with TCP/IP capability. A still larger group of people in an additional 70 countries are able to send and receive electronic mail to computers on the Internet through networks such as USENET, UUCP, FidoNet, and BITNET. Based on the geographic distribution of Internet hosts, it is estimated that 70 percent of Internet users are in the United States with nearly half of those users residing in California.[2] Globally, sub-Saharan Africa is by far the least-connected part of the world.

Internet networks currently transmit data at maximum speeds of 45 Mbps, however, a new very high-speed backbone network service (vBNS) initiated in the spring of 1995 will connect six U.S. supercomputing sites and permit initial data transmission rates of 155 Mbps. The vBNS initiative is a five-year, $50 million cooperative agreement between the National Science Foundation and MCI Telecommunications Corporation. The project will facilitate research in advanced Internet routing technologies and in areas such as energy efficiency and the environment. By the end of the five-year program, data transmission rates may reach 2.2 Gbps (2,200 Mbps).[3]

(continued)

BOX 3-9: The Internet (Cont'd.)

The ARPAnet was replaced by the National Science Foundation (NSF)-funded NSFNet, which until recently spanned the continental United States and had connections outside the U.S. to Canada, Mexico, Europe and the Pacific Rim. NSFNet itself ceased to exist at the end of April 1995 when the cooperative agreement through which NSF carried Internet traffic over the NSFNet backbone expired. The proliferation of commercial backbones and regional network interconnections has eclipsed the need for a federally funded backbone and so NSF will now fund only four regional hubs or network access points (NAPs). These NAPs will serve as neutral interconnection points for all U.S.-based and international Internet traffic. NSF funding of these hubs will be phased out completely over the next four years, ending the federal government's financial support of the Internet.

[1] VocalTec Inc. of Israel began selling a Windows-based software package for voice transmission on the Internet beginning in February, 1995 and was followed by Electric Magic Co. of San Francisco, California in March, 1995. Camelot Corp. of Dallas, Texas expects to ship its version of voice enabling software at the end of June, 1995. Ricardo Castillo, "Standards Tug at Market for Internet Phone Calls," CommunicationsWeek International, Mar. 6, 1995, p. 9.

2 "Internet Notes," Telcom Highlights International, Mar. 1, 1995, p. 18.

3 "NSF Backbone Network Speeding Along," *High Performance Computing and Communications Week*, Apr. 20, 1995, vol. 4, No. 16. p. 3.

SOURCE: Office of Technology Assessment, 1995.

Technology Applications for Economic Development

As can be seen from this table, advances in communication technology can foster economic development in a variety of ways. If, for example, developing countries take advantage of greatly improved cost/performance ratios to deploy communication and information technologies on a national basis, they can increase the size and efficiency of their markets as a result of lower, information-related transaction costs. This possibility is very important for developing countries, where—in some cases—markets do not exist for lack of information (see box 3-10).[65] There will also be productivity gains, because larger, better integrated markets will allow Third World businesses to gain greater economies of scale and scope—a benefit that was not available to them, in most cases, until now.

The trend towards decentralized intelligence throughout communication systems will alsogive rise to economic benefits. Within developing countries there is a lack of people with mid-level skills required for knowledge workers and middle management. Nor is there an adequate commercial and legal structure—such as banks, insurance companies, commercial lawyers, and stock companies—to permit Third World companies to effectively exploit many new business possibilities. With the type of interactive, intelligent information systems that decentralized intelligence allows, businessmen in developing countries can access the required information services via technology. Intelligent networks also provide a platform on which Third World countries can, over the long run, develop their own services and service industries. By taking advantage of such possibilities, the country of Singapore, for example, has become one of the leading business service providers in the world.

[65] For a discussion of market failures in developing countries, see Karla Hoff, Ayishay Braverman and Joseph Stiglitz (eds.), *The Economics of Rural Organization* (New York, NY: Oxford University Press/World Bank, 1993). As the authors of these papers point out, developing country markets are characterized by imperfections of institutions, structures and operations, so that economic signals and incentives fail to reflect the "real costs of commodities or factors." For a discussion of market failures in rural credit markets, see, Timothy Besley, "How Do Market Failures Justify Interventions in Rural Credit Markets," *World Bank Research Observer*, vol. 9, No. 1, January 1994, pp. 27–47.

BOX 3-10: Markets and Information

Communication is inherent in the coordination of all economic activity. A market relies on the communication of information to identify buyers and sellers, allocate resources, and establish prices. Within firms, the availability of timely and accurate information is key to decisions about whether to enter or exit markets, how to secure financing, how to organize working relationships, and how to market and distribute goods. Where adequate information is not available, markets will fail and economic performance will suffer because of higher business costs. Likewise, firms that lack adequate market information will be at a competitive disadvantage.

SOURCE: Office of Technology Assessment, 1995.

Technology Advance in Support of Democracy

The prospects for democracy in developing countries are also greater due to technology advances (see box 3-11). For example, improved networking capabilities, which make it possible to develop specialized, distributed, many-to-many applications such as bulletin boards and groupware, can help individuals locate information; identify like-minded people; deliberate their ideas; organize their activities; and lobby for their points of view. Already, such networks are being used to link special interest groups across national boundaries and with considerable effect (see box 3-12).

The trend towards the unbundling of communication functions and services can also have a significant payoff for democracy. Given the greater flexibility in network design and architecture that unbundling allows, developing countries can deploy customized, lower cost systems in remote areas, thereby extending information access on a much wider basis. The diversity of communication networks is also important for democracy because it permits a greater variety of information sources. This capability is especially important in developing countries, where communications have typically been generated at the center of power and then disseminated outward. Different communication technologies often have different geographic biases, with some being more capable than others in supporting communication both to and within remote areas.[66]

Technology Advance To Support Political Stability

Just as technology advances hold promise to foster economic development and democracy in Third World countries, so too they can play a supportive role in helping to sustain political stability in these areas. For political regimes to be stable, they must not only prove themselves competent in carrying out the affairs of government, they must also be able to assure that basic public needs are met. In addition, if governments are to provide such services without themselves becoming overbearing, the capacity of voluntary associations and local government must be simultaneously upgraded.[67] Communication technologies have something to offer in all three regards.

Taking advantage of the trends toward networking and decentralized intelligence, for example, developing country leaders can, like businessmen, enhance their governing capability by using interactive expert systems and databases (see box 3-13). For even greater benefit, these systems can be networked to let govern-

[66] John Carey, "Space, Time and Communication: A Tribute to Harold Innis," in James W. Carey (ed.), *Communication as Culture: Essays on Media and Society* (Boston, MA: Unwin Hyman, 1989), p. 3.

[67] As described in *Human Development Report 1993,* "Changing the power equation requires the organization of a countervailing force, or even a revolution. People's organizations—be they farmers, cooperatives, residents' associations or consumer groups—offer some of the most important sources of countervailing power. And they often exercise it more effectively through the sharing of information and ideas—it is ideas, not vested interests, that rule the world for good or evil." op. cit., footnote 34, p. 29.

BOX 3-11: Communication and Democracy

Communication and information pervade political life. Without them there could be no nation; for it is through the process of communication that people first develop a sense of community and a shared set of values that legitimize political authority. By magnifying and amplifying some actions, the communication process distinguishes between what is a private act and what is a public affair. It organizes what appears to be random activities to show how individuals and groups are related to one another in pursuit of power, providing a roadmap for individuals who want to influence the course of political events. Citizens rely on the communication process to gather information, identify like-minded people, deliberate their points of view, organize their forces, and articulate their political preferences. Furthermore, because it generates a common fund of knowledge and information, the communication system facilitates productive and rational debate. Without some form of knowledge and understanding of how others are informed and what they believe, individuals could not make reasoned and sensible arguments and decisions.

SOURCE: Office of Technology Assessment, 1995.

BOX 3-12: EcoNet

EcoNet is a virtual community of over 10,000 individuals and organizations in over 90 countries who are working for environmental preservation and sustainability. Members of EcoNet have access to hundreds of private and public online electronic mail conferences through which they exchange information and collaborate on environmental initiatives of local, national or global concern. Individuals or organizations in the United States may pay to join EcoNet through its parent organization—the Institute for Global Communications (IGC) in San Francisco—which is part of the larger Association for Progressive Communications. The EcoNet Internet server provides a gateway not only to the home pages of member organizations such as the National Audubon Society and the Earth Island Institute, but also to the Internet sites of thousands of organizations and government agencies worldwide with information on environmental issues.

SOURCE: Office of Technology Assessment, 1995.

ment officials remotely access the global store of information.[68] Secondly, communication technologies can also be used to distribute public services such as distance healthcare and educational services much more cost effectively. Technology convergence, which provides the platform for nontextual multimedia applications, is especially promising, given the high illiteracy rates in developing countries. Multimedia can also greatly improve the overall quality of healthcare and educational applications (box 3-14). Finally, both of these developments can be used in similar fashions to empower voluntary organizations and local governments.[69]

[68] For discussions of the implications of not having access to scientific and technological information see, Jacques Gaillard, *Scientists in the Third World* (Lexington, KY: University of Kentucky Press, 1991) and Phillip W. Jones, *World Bank Financing of Education: Lending, Learning and Development* (London, UK: Routledge, 1992). Commenting on the lack of scientific journals, books, and other sources of technological information in developing countries, Gaillard notes that of the career scientists interviewed, 36 percent had no communication with scientists in countries where they had originally studied and done their research.

[69] As described by Pieter Kok, "The lack of information and appropriate technology often prevents sustainable community development. Even if community members know what they need, a lack of knowledge of available resources and how to use them effectively easily creates passivity or disinterestedness among beneficiaries. In other cases, it results in the perception that the community's contribution will not make a difference anyway. The result may be one-off development exercises initiated by outside agencies and a long-term dependency on their input." Pieter Kok, "The Role of Information and Technology in Community Empowerment and Development," *In Focus*, February/Market 1995, p. 25.

BOX 3-13: The Sustainable Human Development Network Program

In many developing countries, decisionmakers do not have access to up-to-date information needed to make key policy decisions. One program designed to assist in this regard is the Sustainable Human Development Networking Program (SDNP), established by the United Nations Development Program in May 1992. Participants include 12 countries from Africa, Asia, and Latin America.

The aim of SDNP is to link users and providers of information on sustainable human development via computer networks that operate over the Internet. Designed to complement existing systems, SDNP provides support both for network deployment and training, information generation, and the norms of information sharing and exchange. The program is open to all interested parties, including national governments, non-governmental organizations, academics, business, and the media. The SDNP program builds on local talent and expertise. In addition, each node on the system operates independently of each other, and definitions of sustainable human development are determined locally. Seed money is provided upfront, but projects are intended to become self-financing, so that funding will gradually be reduced by as much as 50 percent or more.

SOURCE: Raul Zambrano, "The UNDP Sustainable Development Network," *Bulletin of the American Society for Information Science,* February/March 1995, pp. 23–24.

DEVELOPMENT CHALLENGES AND OPPORTUNITIES FOR THE FUTURE

How successful developing countries are in employing communication and information depends not only on their present situation and resources, but also on future developments and events. Three major trends are critical in this regard: 1) the emergence of a competitive global economy; 2) the trend towards a knowledge-based economy; and 3) the shift to decentralized, flexible, networked economic activities. Communication and information technologies are not only driving these trends; they can also help developing countries adapt to them.

The Emergence of a Competitive Global Economy

In the period following the second World War, most Third World countries pursued economic development strategies that sought to shelter their economies from global markets. Modeled after the ideas of the renowned Latin American economist Raul Prebisch, these policies aimed to discourage the production of exports—through the use of quotas, taxes, and licenses—while at the same time promoting the domestic production of import substitutes.

The limitations of such an approach became all too clear in 1982, with the onset of the international debt crisis.[70] The few countries that had pursued growth strategies based on export promotion and austerity measures survived the upheavals with their economies intact, whereas those that followed policies based on import substitution did not. Most successful in this regard, for example, were the East Asian countries—Korea, Taiwan, Singapore, and Hong Kong. Between 1960 and 1989, these countries increased their exports from $2 billion (which constituted 5 percent of all developing country exports) to $246 billion (or 32 percent of all developing country exports).[71]

The rapid emergence of a competitive global economy makes any development strategy based on artificial trade barriers increasingly untenable. Pursuing such policies, developing countries will suffer not only by channeling growth away from

[70] See chapter 2 for a discussion.

[71] See Anne O. Krueger, *Economic Policies at Cross Purposes: The United States and the Developing Countries* (Washington DC: The Brookings Institution 1993), p. 105.

BOX 3-14: Project SHARE

Project SHARE, a three-year collaboration on the part of Intelsat and the International Institute of Communications, is one example of the international community working together to use tele-education and telemedicine applications to address the health care and education needs of developing countries. Beginning in 1985, Intelsat made transponder space on its global satellite network available for free to over 20 projects located throughout the world. A total of 22 countries participated in Project SHARE medical projects, while 43 countries took part in various educational projects. Most projects involved interactive or at least one-way video broadcasts and were either one-time events or longer term, recurring projects. In total, over a billion people participated in one or more SHARE projects, which together would have cost in the millions of dollars if provided commercially.[1]

Among the lessons learned from Project SHARE are that cost and lack of technical expertise are significant hurdles to the development of communication infrastructures in developing countries. Often satellite video services were impractical in rural areas of developing countries for lack of earth stations or supporting communication links and equipment. In other cases successful projects were discontinued because the financial or human resources did not exist to sustain them. Another insight gained from Project SHARE is that projects that combined education and health/medicine content were often the most successful and generated the most enthusiasm among participants. This observation highlights the value of telecommunication networks as providing an infrastructure for multipurpose communication.

[1] Joseph Pelton, "Project SHARE: the IIC INTELSAT Experiment in Distance Learning," *Vision and Hindsight, The First 25 Years of the International Institute of Communications,* Winsbury/Fazal.

SOURCE: Office of Technology Assessment, 1995

sectors such as agriculture, which are increasingly recognized as being critical for economic success. By failing to integrate themselves into the expanding global economy, they will also cut themselves off from the many new opportunities that growth in world trade affords.

The integration of the international economy is being driven by a number of related developments. Included among these, for example, are:

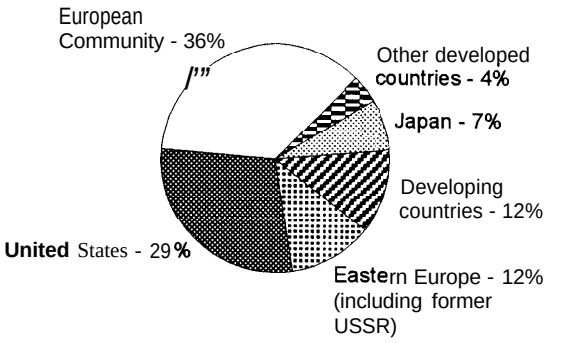
- the increasing similarity among countries with respect to tastes, infrastructure, distribution channels, and marketing approaches;
- the emergence of a global capital market, as witnessed by the large flow of funds between countries;
- declining tariff barriers and the establishment of regional trading agreements;
- shifting opportunities for competitive advantage due to technology restructuring;
- the integrating role of advanced information and communication technologies;
- uneven world economic growth that has fanned the flames of international competitiveness; and
- the emergence of new global competitors, principally from East Asia.[72]

Together, these developments have led to a global economy in which patterns of international trade primarily reflect patterns of international production. Specialization takes place on the basis of parts and specialized components, rather than—as in the past—on the exchange of finished products. Thus, interfirm and intrafirm trade is steadily replacing interindustry trade.[73] Today, for example, Japan provides approximately 40 percent of U.S. component parts in electronics and automobiles.[74]

[72] Michael Porter (ed.), *Competition in Global Industries* (Boston, MA: Harvard Business School Press, 1986), pp. 408–409.
[73] Robert Gilpin, *The Political Economy of International Relations* (Princeton, NJ: Princeton University Press, 1987).
[74] Porter, op. cit., footnote 73.

Patterns of direct investment abroad also highlight this trend toward global economic integration and interdependence. Between 1960 and 1988, for example, direct investment abroad by all firms in all nations increased by over 10 percent per year to more than $1.1 trillion (see figure 3-4).[75] Most important for developing countries, foreign direct investment (FDI) now serves as a major source of capital. Such investment, for example, is today three times greater than the amount of aid funding provided by foreign governments. In 1994, FDI in Third World countries totaled no less than $179.9 billion.[76]

FIGURE 3-4: Share of Major International Joint Ventures



SOURCE: Institute for the Future, "The Electronic Enterprise," contractor report. Prepared for the Office of Technology Assessment, May 1993.

Multinational corporations are also driving the trend toward globalization. To compete in today's global economy, companies must integrate their activities on a worldwide basis, allocating activities among a number of countries to gain the greatest advantage.[77] Depending on the particular case, for example, firms might disperse most of their production facilities (e.g. facilities for design modification, fabrication, and assembly) to foreign countries, while focusing their own domestic production on the fabrication of key components. Alternatively, firms might decide to manufacture their products domestically but transfer abroad downstream activities such as distribution, sales, marketing, and service. When not fully integrated into multinational corporations, these firms are networking their activities across global boundaries through a variety of arrangements such as cross-licensing of technology, joint ventures, orderly marketing agreements, offshore production of components, secondary sourcing, and crosscutting equity ownership .78

These developments also have implications for developing countries. In the past, for example, most largescale Third World companies were subsidiaries of foreign firms. Because the parent firms were located, and directed their operations from, abroad---close to their major suppliers and markets—there were few positive "spillovers" for developing countries. Today, this is no longer the case. Local firms that partner with global companies as suppliers or value--added providers have much more to gain, as India's export-oriented software industry clearly attests.[79] Working with foreign firms, Indian software contractors have been able to access the latest standards, technological platforms, productivity tools, quality requirements, and upfront financing, all of which have been critical to their success.

The Trend Towards an Information-Based Economy

There is an interrelated trend toward a networked information-based economy that will likely have equally important implications for developing

75 John W Rutter, "Direct Investment Update: Trends in International Direct Investment," U.S. Department of Commerce, International Trade Administration, September 1989.

76 "Private Investment to Poor Nations Hits a Record High at World Bank," *The Washington Post*, Jan. 23, 1995, p. A14.

77 Porter, op. cit., footnote 73.

78 Peter Cowhey and John Aronson, *Managing the World Economy: The Consequences Of Corporate Alliances* (New York: Council on Foreign Relations, 1993),

79 Nagy Han, Ken Kuy, and Erik Arnold, *The Diffusion of Information Technology: Experiences of Industrial Countries and Lessons for Developing Countries,* World Bank Discussion Paper, No. 281 (Washington , DC: World Bank, 1995), p. 120.

countries.[80] As information comes to serve increasingly as a primary resource and a key factor of production, many developing countries will find themselves at a new, major crossroad. Given the knowledge, expertise, and intellectual wherewithal, Third World countries have a unique opportunity to "leap frog" from a preindustrial era to an information age. Failure to take advantage of this opportunity, however, may leave developing countries yet further behind.[81] In today's economy, information is treated more and more as a commodity to be bought and sold in the marketplace. As the economic value of information increases, so do the economic rewards of those who have the greatest access to it.[82]

The trend toward a networked, information-based economy results, in part, from the deployment of information and communication technologies. These technologies provide numerous ways to improve efficiency and increase productivity, and thus engender growth. Information is, for example, reusable. Unlike capital resources such as steel and iron, it requires very few physical resources to produce and distribute. Information can be used, moreover, to substitute more efficiently for labor and to improve the overall efficiency of the productive process itself. As productive processes become increasingly complex, the largest reserve of economic opportunities will be in organizing and coordinating productivity activity through the process of information-handling.[83]

Technology advances have also given rise to new businesses that specifically cater to business information needs. Information can now be processed in a variety of new ways, adding to its value from the point at which it is created or composed to the point at which it is assimilated or used. As the opportunities for creating new information products and services have increased, so too have the number of commercial providers. Responding to the increased demand for information, the new technologies have spawned a rapidly growing industry. For example, in 1992, the worldwide market for online services totaled $10.1 billion, a 9.2 percent increase from $9.3 billion in 1991 (see box 3-15).[84]

If developing countries deploy advanced communication technologies in tandem with developed countries, they can also compete in this expanding global market on a more equal basis. One of the first countries to recognize this opportunity was Singapore, which has greatly prospered as a result. By 1990, Singapore had become the 17th-largest trading nation in the world, and was home to the regional headquarters of more than 600 multinational corporations.[85]

When, for example, in the early seventies multinational corporations began to transfer their manufacturing operations from Singapore to lower cost labor countries such as Malaysia, Thai-

[80] OTA, *Electronic Enterprises*, op. cit., footnote 4.

[81] As described by Manuel Castells, "The critical point is that the current dramatic transformation of the world economy into a dynamic, highly integrated system could bypass entire countries or the majority of their population. ...Within the framework of the new information economy, a significant part of the world population is shifting from a structural position of exploitation to a structural position of irrelevance." Martin Carnoy, Manuel Castells, Stephen S. Cohen, and Fernando Cardoso (eds.), *The New Global Economic in the Information Age: Reflections on Our Changing World* (University Park, PA: Pennsylvania State University Press, 1993), p. 37.

[82] As noted by Merrifield, "Wealth will no longer be measured primarily in terms of ownership of fixed physical assets, but rather in terms of time-critical access to needed resources; and to knowledge-intensive value-added operations. The value-added dimension, moreover, will be the deciding source of the comparative advantage required for industrial competitiveness. This shift in the basis of wealth formation is a major break with the past, a discontinuity that is driven by accelerating forces of change. One of these factors involves an explosion of technology that has created about 90 percent of all scientific knowledge over just the last 30 years. Moreover, this knowledge base is likely to double again in the next 15 years. D. Bruce Merrifield, "Global Strategic Alliances Among Firms," *International Journal of Technology Management, Special Issue on Strengthening Corporate and National Competitiveness Through Technology*, vol. 7, 1992, p. 77.

[83] Charles Jonshur, "Information Resources and Economic Productivity," *Information Economics and Policy I* (North Holland: Elsevier Science Publishers, 1983), pp. 13–35.

[84] *Online Services: 1993, Review, Trends & Forecast* (Wilton, CT: SIMBA/Communication Trends, 1993), p. 11.

[85] Robin Mansell and Michael Jenkins, Networks, Industrial Restructuring, and Policy: The Singapore Example," in *Technovation*, vol. 12, No. 6, Sept. 1992.

BOX 3-15: Annual Online Publisher Growth

The online services market is growing rapidly. Worldwide sales in 1992 topped $10.1 billion. Of this amount, North American-based companies accounted for 60 percent and European-based companies accounted for 32 percent. Annual sales growth was 9.2 percent in 1992 and averaged 9.1 percent between 1983 and 1992 in the number of databases, database producers, and online services (vendors who distribute database information. While these numbers are large, they are only a subset of a much larger information market that includes the sale of information and services over private networks, electronic data interchange (EDI), networking offered by value-added networks (VANs), airline customer reservations systems (CRSs), real-estate multiple-listing services (MLSs), electronic funds transfers (EFTs), and automated teller machines (ATMs).

SOURCE: Gale Directory of Databases, Volume 1: Online Databases, Gale Research, Detroit, MI, 1993.

land, and Indonesia, the Government of Singapore was quick to adopt a more service-oriented, export-led strategy. Recognizing the role that the communication and information infrastructure might play in capturing the benefits of global trade, government officials undertook to create a totally electronic trading environment, with the aim of transforming Singapore by the end of the century into an "intelligent island." By providing multinational corporations efficient, one-stop global networking and value-added trade services, Singapore was able to establish itself as the major trading hub in Asia.[86]

As the benefits of using communication networks increase, so too do the costs of not having access to them. Opportunity costs are especially high in the case of networking technologies because they give rise to "first mover advantages." Thus, as Singapore clearly recognized, the first country to establish a technology-based global trade network can gain a hefty competitive advantage, not just because the capital costs entailed are so high, but also because electronic networks require considerable "learning by doing." Moreover, once business users have expended the energy, expertise, and financial resources required to use a particular network, and have become linked up with other network users, they tend to get "locked in."[87]

The Trend to Decentralized, Flexible, Networked Economic Activities

To gain competitive advantage in a knowledge-based, global economy, firms must also adopt entirely new ways of doing business. Global customers are now more diverse and sophisticated, and new, highly skilled competitors require communication networks to participate in foreign markets. Success in the global economy no longer depends only on achieving efficiency and cost reduction.[88] Increasingly, it depends on the effectiveness of businesses—their ability to innovate, respond just in time, focus on quality, and establish more cooperative interfirm and intrafirm relationships. To enhance their effectiveness, firms are taking advantage of more timely and appropriately packaged information to help them shift from business models based on mass production to those centered around the concept of flexible, decentralized production.

Networked information technologies are especially useful in helping firms to restructure and

[86] "Asia-Pacific Telecom Hubs: Let's Make A Deal," Data Communications Magazine, vol. 24 No. 8, pp. 53–54.

[87] See Joseph Farrell and Garth Saloner, "Horses, Penguins and Lemmings," in H. Landis Gabel (ed.), *Product Standardization and Competitive Strategy* (The Netherlands: North Holland, 1987).

[88] R. Ray Gehani, "Concurrent Product Development for Fast Track Corporations," *Long Range Planning*, vol. 25, No. 6, pp. 40–47, 1992.

reengineer their operations to be more competitive. Businesses are using these technologies to reorganize their activities into more versatile and flexible networks and teams. Some businesses, for example, are using networking technologies to build long-term, integrated business relationships with their customers and suppliers. Others are teaming up with outside firms for specific short-term ventures. Some of these business relationships, operating through electronic networks, cross national as well as organizational boundaries. Networking technologies such as wide area networks (WANs), videoconferencing, computer integrated engineering, and manufacturing and electronic data interchange (EDI) are necessary to support these flexible business arrangements (see box 3-16 and box 3-17).[89]

In addition to having an impact on how firms conduct their business, information and communication technologies also affect the size, structure, and openness of markets. As these technologies are integrated into reliable commercial networks, more trade will take place in electronic markets, online. How these electronic markets evolve, and the form that they take, will have significant consequences for the functioning of the global economy. Electronic markets can reduce the net costs of doing business, and thus improve overall efficiency and expand trade. However, if these networks fail to interconnect, or are unevenly deployed, they could create technological barriers to trade and restrict competition.[90]

For Third World countries to compete on an equal footing and partner with companies in the First World, they too will need to reorient their businesses away from mass production towards just-in-time, flexible production. While information and communication technologies are not necessarily essential to carrying out these organizational changes, having access to them can greatly expand a firm's opportunities and enhance its efficiency by reducing transaction costs (see appendix A).[91]

With networking technologies, even small businesses will be able to expand their activities.[92] A small business serving a single niche market in a developing country, for example, can increase its size by using communication technologies to identify similar niche markets in other countries. Small firms in developing countries can also use networking technologies to partner with the growing number of globally dispersed firms that outsource many activities to Third World countries. Or, alternatively, small businesses can use communication networks to link their operations together, allowing them to function and compete as if they were much larger entities. This kind of networking approach was used, for example, by the Italian clothing manufacturer, Benneton, with remarkable success.[93]

National governments have not been alone in recognizing the potential for information networking to enhance global trade. Recently, for example, the U.N. sponsored the global Trade Point Program, which aims to promote trade through the establishment of a series of "trade

[89] OTA, *Electronic Enterprises*, op. cit., footnote 62.

[90] Ibid.

[91] Some of the most successful early applications of this approach, for example, took place in the industrial districts of Northern Italy and Baden-Wurttemberg, Germany, where technology was not an issue.

[92] As described by R. Badrinath, "Previously, gaining entry into distant markets was out of the question for a majority of [small and medium sized enterprises] SMEs. Even assuming that they could organize the finance and production aspects of their operations effectively, foreign marketing raised almost insurmountable obstacles. The process of market selection, buyer identification, visits abroad with quantities of samples, preparation of business offers and counter proposals, discussion of specifications and so on required large investments of time, energy, and resources. Today, much of this can be done without leaving the workplace, thanks to the telephone, fax and other telecommunication facilities." R. Badrinath, "Helping Small and Medium-Size Firms to Enter Export Markets," *International Trade Forum*, No. 2, 1994, p. 6.

[93] See Cristiano Antonelli, "New Information Technology and Industrial Organization—Experience and Trends in Italy," in *Information Technology and New Growth Opportunities* (Paris, France, OECD Development Center Studies, 1989).

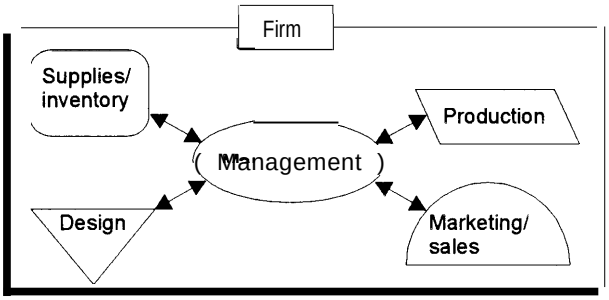
BOX 3-16: Networking for Economic Advantage

Networking provides new opportunities for businesses to enter new markets, gain strategic advantage, and reduce transaction costs. These networks are effective because they cut across traditional organizational boundaries, either within or across firms,

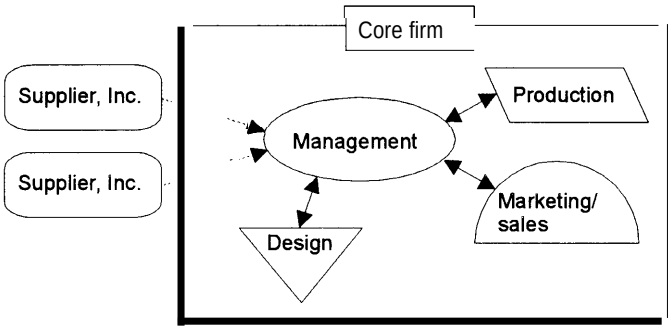
Business networks come in a number of varieties, As depicted in the figure, some networks are internal to the firm. They generally cut across traditional business functions, allowing firms to reorganize around processes that support team-based work for total quality control and just-in-time delivery. A wide range of groupware applications are being developed to support such networks. Businesses may also set up networks to create new interorganizational connections as can be seen in section B. An electronic data interchange (EDI) network might be used, for example, to connect a firm to its suppliers. Networking can also be used to support virtual corporations and agile manufacturing as illustrated in section C.

SOURCE: Office of Technology Assessment, 1995

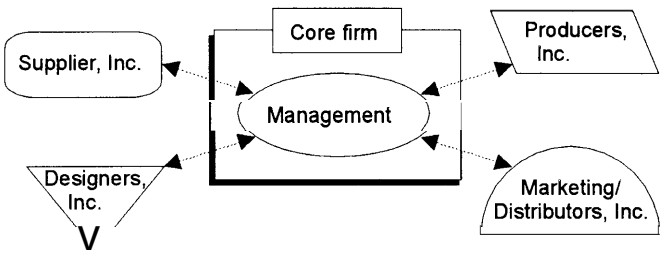
A: Fully-integrated firm



B: **Outsourcing**



C: Virtual corporation

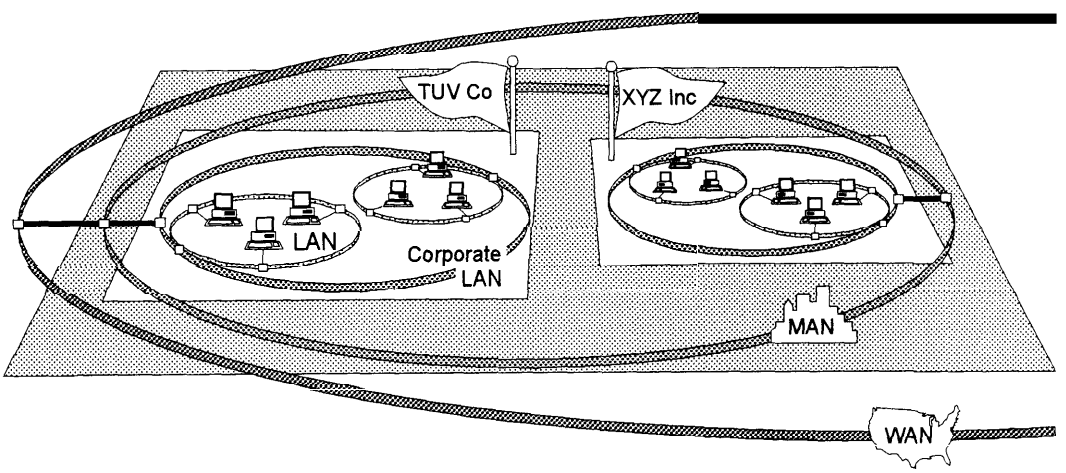


BOX 3-17: Networking for Enterprise Integration

Enterprise integration is presently facilitated by the use of shared information systems, across groups and facilities, so that teams can leverage the information resources of others, wherever they may be. To support enterprise integration, communication must be seamless and reliable so information can be relayed in a timely manner and without errors.

There are a number of technologies that support shared information systems. Networking options include local area networks (LANs), wide area networks (WANs), and metropolitan area networks (MANs), supported by a vast array of transmission and networking technologies, including asynchronous transfer mode (ATM), integrated services digital network (ISDN), fiber optics, satellite, and many other radio-based technologies. The figure illustrates how the data communications portion of the information superhighway is composed of a complex network of interconnected networks. A firm's internal computer network typically consists of several smaller, linked LANs, which in turn are interconnected to increasingly wider networks, MANs and WANs. Open systems architecture and object-oriented programming environment will enable systems to be built more efficiently and effectively to facilitate information-sharing. Client/server architectures that distribute data over a network of desktop workstations (as opposed to having the data reside in a central mainframe computer) will allow departments to own their own data and make it available to the people who need it. Software such as groupware and distributed databases will provide the ability to store, search, and refine disparate pieces of information.

SOURCE: Office of Technology Assessment 1995.



points" or trade facilitation centers that provide companies with greater access to communication networks and trade-related information. Already there are 59 such Trade Points in 45 countries serving as clearinghouses for trade leads, custom and tariff information, sources of financing, qualified freight forwarders and insurers, and market overviews. Trade Points offer services either physically, in a centrally located office, or online by connecting customers and service providers electronically. Depending on available resources, Trade Points may also offer the use of communication technologies such as voice and video conferencing, electronic mail, bulletin

boards and shared databases. In addition to the free resources offered on the Internet, Trade Points have begun to provide trade information generated by the private sector, as well as space on its Internet server for company home pages, on a fee basis. The U.N. estimates that 100 Trade Points will be in operation by 1996.

Meeting Third World Needs in a Global Telecom Market

4

Information and communication technologies, operating in a newly deregulated and increasingly competitive economic climate, are rapidly reconfiguring national communication systems and linking them together into networks that span the globe. This has greatly reduced telecommunication costs and generated a wide range of new products and services.[1] As a result, telecommunications is one of the fastest growing sectors in the international market, with total sales of $400 billion in 1992 and annual growth rates averaging between 10 to 15 percent.[2]

Increases in the flow of and demand for information services across national borders are wearing away the distinction between domestic and international communication systems and markets. Whereas national monopolies once controlled the manufacturing, production, and provisioning of most communication related products and services, today international conglomerates are being formed to meet the business demand for transparent and seamless worldwide services.

In this increasingly liberalized, global telecommunications marketplace, many developing countries' communication needs can be met by the private sector. Already, many firms are eagerly competing to invest in and/or partner with developing countries to serve their rapidly growing communication markets. U.S. firms are especially well positioned in this regard. They are foremost in the development and deployment of communication and information technologies and principal players in the information and communication technology and service trade arena.

Although the global market is driving the deployment of advanced communication technologies, and channeling investments in telecommunications to developing countries, its impact will likely be uneven, with some countries and some areas remaining unserved. In many developing countries, existing infrastructure is very primitive, providing in some cases less than one

[1] For example, the price of leasing a single voice-grade channel in 1970 was between $8,000 and $9,000 per month. Today it would cost about $6,000 to lease a 64 kbps line that could provide eight times more transmission capacity. See Michael Fahey, "From Local to Global: Surveying the Fiber Landscape," *Telecommunications*, November 1993, p. 34.

[2] "Expanding Your Orbit," *Public Utilities Fortnightly*, Feb. 1, 1993, p. 27.

main telephone line per 100 persons.[3] And the cost of upgrading these networks can be astronomical—on the order of $60 billion according to some estimates.[4] Compounding the problem, many developing countries have only limited access to the foreign exchange required to purchase up-to-date equipment and services in the global market.

To meet the needs of all developing countries in a global economy, some foreign assistance and support may be required. The need for such support is typical in the case of communication technologies. Historically, for example, most national governments have found it necessary to promote universal access and the deployment of communication infrastructure, owing to the failure of the marketplace to support universal service and other related economic and social goals.

The economic incentives provided in today's international marketplace may similarly inhibit the deployment of technology to all corners of the earth, rich and poor alike. In a highly competitive, global economy, however, Third World governments can not—as did governments in the past—speed up and smooth out the technology diffusion pattern, using cross subsidies and price averaging. To the contrary, if Third World countries are to attract worldwide business and investment in telecommunications, they must dismantle their traditional regulatory regimes and veer toward greater liberalization and privatization. Otherwise, they will most likely be bypassed altogether.

In an interdependent global environment, the United States has an interest—from a trade as well as from a foreign policy perspective—to help ensure that technology deployment proceeds on a relatively even basis. Designing a telecommunications oriented foreign aid program, which carefully targets unserved areas and leverages free market, private sector developments, however, will require a clear understanding of potential market failures and barriers to deployment in a global telecommunications market.

This chapter seeks to contribute to such an understanding. To this end, 1) it characterizes the typical technology diffusion pattern associated with communication networks and the key factors likely to affect it; 2) it examines how this pattern might be influenced by the forces driving globalization of the telecommunications market; and 3) it identifies and describes the implications for Third World countries of the most probable deployment scenario.

THE DIFFUSION OF COMMUNICATION NETWORKS

Technology diffusion is typically a long-term and uneven process that depends on a number of factors, making it very difficult to access in any event.[5] The problem of predicting diffusion rates is compounded in the case of a networked communication infrastructure. Because the infrastructure as a whole is constituted by hundreds of technologies coexisting, each at different points on their diffusion curves, how quickly communication innovations are adopted is highly dependent on factors such as interconnectivity and the interdependence of content and equipment. Moreover, because communication infrastructures support both social and economic activities, network evolution will probably be determined by many social and political factors as well as by technological and economic factors. Not surprisingly, therefore, national governments have generally played a major role in determining network deployment and use.

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[3] According to the International Telecommunications Union (ITU), by the end of 1992 almost 50 countries accounting for more than half the world's population had a teledensity of under one main telephone line per 100 people; at current growth rates this situation will not change until the end of the century. Denis Gilhooly, "Road to Kyoto," *CommunicationsWeek International*, Sept. 12, 1994, p. 12.

[4] According to the ITU *World Telecommunications Development Report*, it will cost $58.3 billion to provide basic infrastructure to most nations. The World Bank estimates the cost to be even greater, totaling $80 billion. Stephen Titch and John Williamson, "World Conference Pushes for Policy Changes," *Telephony*, Mar. 28, 1994, pp. 9, 7.

[5] For a crosscultural and crosssectoral analysis, see Pavio Arcageli, Giovanni Dosi, and Massimo Moddi, "Patterns of Diffusion of Electronic Technologies: An International Comparison with Special Reference to the Italian Case," *Research Policy*, vol. 20, 1991, pp. 515–529.

Major Technological/Economic Factors

As a general rule, the diffusion of new technologies takes the form of an S-shaped curve. This pattern reflects the forces of supply and demand, and the way in which users respond to new technologies. Vendors market new technologies slowly at first because investment and product development costs are high, while demand and profitability are low. As costs and prices fall and demand and profits rise sharply, vendors will greatly increase their supply.[6] Users reinforce this pattern. Their initial reaction to new technologies is generally very cautious, but their demand will eventually quicken and reach a critical mass as prices fall, knowledge of and familiarity with the technology spreads, and applications multiply and are adapted and readapted to new and different tasks.[7]

Achieving a critical mass is especially important in the case of interdependent networks.[8] Because these networks represent a large installed base, users are generally reluctant to purchase incompatible components. Instead, they may postpone the adoption of new, superior technologies until their entire network can be written off. On the other hand, once there is a critical mass, users will likely "jump on the bandwagon." This happens because network users and network services are, like network components, also interdependent. The value that users attach to a network will generally increase in proportion to the number of users it has, and the services it can support. Thus, when a critical mass of users adopts a new technology, others are quick to follow, fearing they will be left behind.[9] As has generally been the case, when teledensity approaches the range of 10 to 20 percent, communication networks will likely "take off."

Even after a critical mass has been achieved, however, diffusion will continue to be patchy, typically following a hierarchical pattern. Such a pattern was clearly evident, for example, in the case of the United States with the deployment of the telephone and telegraph. In both instances, diffusion followed a sequential pattern starting in areas with major populations. First, major trunks were linked to Northeastern cities, followed by lines to smaller towns in their immediate hinterlands. Then, connections were made to major Midwestern cities, which were later extended outward in a similar fashion. Although the telephone was patented in 1876, it did not reach Chicago until 12 years later, and transcontinental service was not inaugurated until 1915. For rural areas, the situation was even worse. As late as 1940, only 25 percent of all farm residences in the United States had telephone service. As a result, favorably situated businesses in the urban Northeast enjoyed a head start of several decades in utilizing regional and interregional telephony.[10] In the case of the telegraph, it took 17 years to link both coasts, with the small towns and rural areas again being the last to be served.[11]

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[6] Christopher Freeman, *The Economics of Industrial Innovation* (Cambridge, MA: MIT Press, 1982); and Edwin Mansfield, "The Diffusion of Eight Major Industrial Innovations," N.E. Terleckjy (ed.) *The State of Science and Research: Some New Indicators* (Boulder, CO: Westview Press, 1977).

[7] Everett M. Rogers, *Communication Technology: The New Media in Society* (New York, NY: The Free Press, 1986); pp. 116-149; and Ronald Rice and Everett Rogers, "Reinvention in the Innovation Process," *Knowledge: Creation, Diffusion, Utilization*, vol. 1, No. 4, June 1980, pp. 499–514; See also Paul Attewell, "Technology Diffusion and Organizational Learning: The Case of Business Computing," *Organizational Science*, vol. 3, No. 1, February 1992, pp. 1–19.

[8] See Cristiano Antonnelli, "The Economic Theory of Information Networks," in Cristiano Antonnelli (ed.), *The Economics of Information Networks* (The Netherlands: North Holland, 1992), chap. 1.

[9] Joseph Farrell and Garth Saloner, "Horses, Penguins, and Lemmings," H. Landis Gabel (ed.), *Product Standardization and Competitive Strategy* (The Netherlands: North Holland, 1987); and Paul A. David, "The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox," *American Economic Papers and Proceedings*, May 1990, pp. 355–361.

[10] Richard Kielbowitz, "The Role of Communication in Building Communities and Markets," contractor report prepared for the Office of Technology Assessment, 1987.

[11] Ibid. See also Richard DuBoff, "The Telegraph and the Structure of Markets in the United States, 1845–1890," *Research in Economic History*, vol. 8, 1983, pp. 269–270; and U.S. Department of Agriculture, Rural Electrification Administration, *A Brief History of Rural Electric and Telephone Programs* (Washington, DC: USDA, REA, 1989).

Recent networked communication technologies have followed a similar pattern. Included among these, for example, have been commercial television stations, cable television, competitive long distance services, AT&T data services as well as interuniversity BITNET e-mail systems.[12] Even the fax machine, which has had a very rapid rate of diffusion, exhibited this same pattern. Like the telephone, many of these technologies were initially driven by business usage.

The Role of Government in Supporting Network Diffusion

National governments have played a major role in determining the evolution of communication technologies. Viewing these technologies as a critical infrastructure that sustains all social activities—political, economic, and cultural alike—governments have, over time, consistently intervened to either promote or retard their availability.

In the United States, the Founding Fathers recognized that the widespread flow of communication was essential to developing a unified market, forging a common culture, and creating a democratic polity. To foster such communication, they incorporated three important provisions in the Constitution—the First Amendment provision for free speech; the authorization of intellectual property protection under Article 1, Sec 8; and Article 1, Sec. 8, Paragraph 7, which gives government the power to establish post offices and postal roads.[13] This goal of fostering communication has persisted throughout American history. Almost 150 years after the Constitution was written, Congress reaffirmed this commitment with the passage of the Communications Act of 1934. This act laid out the objective of providing "so far as possible, to all people of the United States, a rapid, efficient, nationwide, and worldwide wire and radio communication service with adequate facilities at reasonable charges."

To implement its objective, the U.S. Government adopted a regulatory framework that, while allowing the industry to remain in private hands, still provided some social control over the negative impacts of the single-mindedness of the market. Under this system, the telephone company was permitted to operate as a regulated monopoly, while serving the public interest as a common carrier.[14] And, when this system failed to promote adequate service in rural areas, the government took more proactive measures to encourage deployment, by channeling loans and technical assistance through the auspices of the Rural Electrification Administration (REA).[15]

As the United States became drawn into the world of international politics, communication policies were designed not only to support domestic policy goals but foreign objectives as well. Thus, for example, the U.S. government—having witnessed the military benefits of radio technology first hand during World War I—intervened to help establish the Radio Corporation of America (RCA), which subsequently bought out the British dominated American Marconi Company. In this way, the Government helped to solidify the U.S. position in international communication.[16] Similarly, to meet the defense needs of World War II, the U.S. government took the lead in providing the necessary finance and support required for the development of a number of critical communication and electronic technologies.[17] To support U.S. foreign policy throughout the Cold War, the government

[12] Aharon Kellerman, *Telecommunications and Geography* (London, UK: Belhaven Press, 1993).

[13] Ithiel de Sola Pool, *Technologies of Freedom,* (Cambridge, MA: Belknap Press of Harvard University, 1983), pp. 16–17.

[14] See Richard A.K. Vietor, "AT&T and the Public Good: Regulation and Competition in Telecommunications, 1910-1987," Harvard Business School, unpublished paper, April 1987, revised March 1988.

[15] Legislation permitting REA to play such a role was passed in 1949. Accordingly, REA was able to achieve high-quality, state-of-the-art service, working mainly with the "independent" telephone companies. By 1980, 90 percent of all farms in the United States were served by telephones. U.S. Department of Agriculture, op. cit., footnote 11.

[16] Daniel J. Czitrom, *Media and the American Mind,* (Chapel Hill, NC: University of North Carolina Press, 1982), p. 86.

[17] David C. Mowery and Nathan Rosenberg, *Technology and the Pursuit of Economic Growth,* (New York, NY: Cambridge University Press, 1989), p. 144.

promoted the values of democracy and a free market economy through the Voice of America Service.

Historically, some foreign governments have gone much further than the U.S. government to ensure that their telecommunication systems not only support but actually promote, national social and economic goals.[18] To this end, most foreign governments have assumed direct ownership and control over their telecommunication networks.[19]

The typical organizational pattern to emerged in Europe—and later worldwide—was that of the PTTs—the government administrations of post, telephone and telegraph. The hierarchical, government-owned monopoly model evolved in Europe over a century and a half, during which time national governments, coveting the lucrative postal revenues, finally, and after intense struggles, assumed control over their respective postal systems. Eventually, however, it was the telephone that provided revenues to subsidize the PTTs activities. The PTTs are, thus, much more than administrative agencies; they are deeply embedded in national social and political structures.[20]

Government policy will continue to play a critical role in determining technology diffusion. However, to partake of the benefits of new technologies, governments must reassess and adapt their communication policies and institutions to take into account the fundamental social and economic changes occurring in their midst. The rate-based regulatory framework that served well in the early years of telephony, when a common, universal service was required, is no longer appropriate today, given the variegated communication needs of a knowledge-based global economy.[21]

With the breakup of the Bell Telephone System in January 1984, the United States created a worldwide precedent, and set the pace for regulatory reform (see box 4-1). Under similar pressures today—made even more powerful by the threat of global competition—many countries throughout the world are reassessing, if not restructuring, their regulatory policies. Despite, in some cases, considerable resistance, a number of these countries are already dismantling their Postal and Telecommunication Administrations (PTTs) in favor of some form of privatized ownership and liberalization of entry barriers.

Describing the motivations and tensions inherent in these kinds of decisions, one observer has noted:

> Perhaps for the first time communications are being recognized as a strategic underpinning of civilization, as important perhaps as the provision of clean water. The implicit fear for many countries must be that an inadequate infrastructure will forever keep a national economy out of the world economic structure that is shaping up for the 21st century, in addition to the fear that government relinquishes an important tool. It is into this cauldron that telecom policy is being pushed.[22]

Given this radically changing international regulatory environment, developing countries will probably have less opportunity than the developed countries once had to use government policies to assure the widespread and even deployment of communication networks.

THE TREND TOWARD GLOBAL NETWORKING

Technology diffusion does not take place in isolation. It is influenced greatly by the larger technological, social, and economic context in which new technologies evolve. The single, most over-

[18] Andrew Davis, *Telecommunications and Politics: The Decentralized Alternative* (New York, NY: St. Martin's Press, 1994), pp. 62–63.

[19] Eli Noam, "The Establishment of the PTT System," in Eli Noam, *Telecommunications in Europe*, (Oxford, UK: Oxford University Press, 1991).

[20] Noam, op. cit., footnote 19.

[21] Eli M. Noam, "The Future of the Public Network: From Star to the Matrix," *Telecommunications*, March 1988, pp. 58–59, 65, and 90.

[22] Stephen McClelland, "The International Dimensions: The PTTs," *Telecommunications*, June 1992, p. 31.

BOX 4-1: The Demise of the U.S. Telecommunication Regulatory Regime

Technological developments were a major factor in the demise of the U.S. regulatory regime. The convergence of information and communication technologies blurred the distinction between what constituted a monopoly—and hence regulated—service and what constituted a competitive service to be provided in the marketplace. In addition, as new technologies both increased in capability and declined in cost, the barriers to entry into the telecommunications market were greatly reduced. Under these circumstances, many newcomers were able to make significant inroads into AT&T's traditionally protected market. Their chances for success were greatly enhanced, given the requirement that AT&T provide universal service, while its competitors could target products to the most lucrative business markets. Thus, new providers put pressure on the system of subsidy pricing, which had been so elaborately constructed over the years.[1]

Economic developments also greatly increased the incentives for others to try to enter the telecommunication/data communication market. In particular, as information came to play an enhanced and more strategic role in the realm of business, large users began to seek alternative, more efficient ways of purchasing telecommunication services.[2] Where their needs were great, or where they wanted more strategic control over their operations, users established their own internal telecommunication networks. In other cases, business users were able to make the best deal by bypassing the Bell System and purchasing services and equipment in the unregulated market.

Changes were also taking place in the way regulators thought about the regulatory structure.[3] As early as 1962, a number of regulatory economists began to question the public-utility concept. Together, their work—if it did not itself give rise to the new deregulatory climate—served at least to legitimate it.[4]

Under similar pressures today—made even more powerful by the threat of global competition—many countries throughout the world are reassessing, if not restructuring, their regulatory policies. Despite, in some cases, considerable resistance, a number of these countries are already dismantling their Postal and Telecommunication Administrations in favor of some form of privatized ownership and liberalization of entry barriers. Describing the motivations and tensions inherent in these kinds of decisions, one observer has noted:

> ...Perhaps for the first time communications are being recognized as a strategic underpinning of civilization, as important perhaps as the provision of clean water. The implicit fear for many countries must be that an inadequate communication infrastructure will forever keep a national economy out of the world economic structure that is shaping up for the 21st century, in addition to the fear that government relinquishes an important tool. It is into this cauldron that telecom policy is being pushed.[5]

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[1] For a discussion of this pricing system, see *Separation Procedures in the Telephone Industry: The Historical Origins of a Public Policy* (Cambridge, MA: Harvard University, Center for Information Policy Research, 1981).

[2] Dan Schiller, "Business Users and the Telecommunications Network," *Journal of Communication*, vol. 32, No. 4, Autumn 1982.

[3] For one discussion, see Alfred E. Kahn, "The Passing of the Public Utility Concept: A Reprise," in Eli Noam (ed.), *Telecommunications Regulation Today and Tomorrow* (New York, NY: Harcourt Brace Jovanovich Publishers, 1983), ch. 1; For an account of these changes in attitude as seen from within the regulated industry, see Peter Temin, *The Fall of the Bell System* (New York, NY: Cambridge University Press, 1988), who argues that changes in ideology were in many ways more significant than changes in technology.

[4] As Roger Noll has described, "Economists generally entered the study of regulation with the naive view that regulatory institutions were set up for the purpose of rectifying market failures. Unfortunately, and almost without exception, the early empirical studies—those commencing in the late 1950s and continuing into the 1970s—found that the effects of regulation correlated poorly with the stated goals of regulation. By the early 1970s, the overwhelming majority of economists had reached consensus on two points. First, economic regulation did not protect consumers against monopolies, and indeed often served to create monopolies out of workably competitive industries or to protect monopolies against new firms seeking to challenge their position. Second, in the circumstances where market failures were of enduring importance (such as environmental protection) traditional standard-setting regulation was usually a far less effective remedy than the use of markets and incentives." Roger G. Noll, "Regulation After Reagan," *AEI Journal on Government and Society*, No. 3, 1988, pp. 13–20.

[5] Stephen McClelland, "The International Dimensions: The PTTs," *Telecommunications*, June 1992, p. 31.

SOURCE: Office of Technology Assessment, 1995.

riding contextual factor affecting the pattern of technology deployment in Third World countries today is the trend towards global communication networking. Thus, to anticipate the evolution of communication technologies in developing countries, it is necessary to begin by considering what such globalization might entail.

Globalization Defined

The term "globalization" suggests two related, but nevertheless distinct phenomena, which can at times work in opposition to each other. One relates to notions of comprehensives and universality.[23] Global communications, as embodied in these notions, entails the distribution of communication networks and information flows on a worldwide, and equally accessible basis. The value or goal implied by this use of the term globalization is availability and access, while the means for achieving this goal is technology advance and deployment. Thus, measures of this type of globalization might include the ubiquity of technology and technology applications, as well as the cost and connectivity of technology.

The second meaning attached to the term globalization relates not to geographic scope, but rather to territorial boundaries. In this sense, globalization can be said to occur when social interactions and transactions transcend territorial, state boundaries, and thereby supersede both national and intergovernmental decisionmaking processes.[24] From this perspective, globalization of communication entails a shift in the provisioning of communication and information from the public to the private sector in an international marketplace. The value associated with this shift is efficiency; communication resources are assumed to be more efficiently allocated if provided in response to global market signals of supply and demand. Evidence and measures of this type of globalization might take the form, for example, of the growth and development of a world market for communication and information products and services; the proliferation in the number and variety of private sector communication providers; or the emergence of new, transnational and nongovernmental centers of decisionmaking.

These two types of globalization are interrelated, often driving one another. The global deployment of communication technologies, for example, facilitates the development of transnational organizations. These organizations, in turn, through their demand for communications, help to drive the diffusion of technology and the development of a global marketplace.

The interrelationship between the two types of globalization may not always be mutually reinforcing, however. The values of universality and efficiency sometimes conflict. As the history of technology diffusion illustrates, market incentives may be insufficient to support both universal service and other, related social and economic goals. Nor is the international marketplace, on its own, likely to give rise to communication networks that are interconnected on a global basis.

Globalization as Measured by Deployment and Interconnection

Just as the birth of the telegraph, telephone, and television gave rise to communication systems and networks that stretched across the globe, so too will many of the technology advances being witnessed today facilitate worldwide access. However, whether or not these advances promote worldwide access will depend not only on technology but also on the technological and regulatory mechanisms that provide for interconnection.

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[23] *Webster's Third International Dictionary*.

[24] As Ruggie describes, "Perhaps the best way to put it is that the globe itself has become a region in the international system, albeit a nonterritorial one. Thus, global does not mean universal. Instead the concept refers to a subset of social interactions that take place on the globe. This subset constitutes an inclusive level of social interaction that is distinct from the international level, in that it comprises a multiplicity of integrated functional systems, operating in real time, which span the globe." John Ruggie, "International Structure and Institutional Transformation: Space, Time, and Method," in Ernst Otto Czempiel and James N. Rosenau, *Global Changes and Theoretical Challenges: Approaches to World Politics for the 1990s* (Lexington, MA: Lexington Books, 1989), p. 31.

New Technological Capabilities

As described in chapter 3, major improvements continue to be made with respect to all aspects of communication networking. These advances are fostering both the supply and demand of communication systems and services. Cost reductions and improvements in performance support the extension of communication systems and services over wider geographical areas. Global demand is stimulated by the reductions in the cost of service provision, improvements in network capabilities, as well as by the development of new and more flexible communication systems and services.

One major step toward global service capacity has been the development of fiber optic technology. Most fiber optic lines in use today can handle a maximum of 32,000 long-distance calls simultaneously, or 2.5 billion bits per second. Researchers at AT&T's Bell Laboratories, however, have recently transmitted 300 billion bits of information per second down a single strand of fiber, a technology which may be commercially available in as little as two and a half years.[25] These gains in capacity have, moreover, been matched by a decline in price. At present, the price per unit of transmission for fiber optics has been dropping at a rate of 40 percent per year.[26]

Improvements in fiber optics have not only greatly reduced costs and increased capacity; they have also facilitated digital connectivity among nations. As a result, an unprecedented number of new transoceanic fiber cable projects have been undertaken in the past few years (see table 4-1).[27]

The undersea fiber-optic cable system AMERICAS-1—the first fiber-optic cable connecting Latin America, the Caribbean and the United States—is capable of handling anywhere from 80,000 to 320,000 simultaneous phone calls or the equivalent voice and data.[28] Other projects include the 12,000 kilometer Asia Pacific Cable Network to link eight countries in the Asia-Pacific region by 1996, and a 2,200-mile fiber-optic cable in the Black Sea region being built by a consortium of 30 telecommunications companies.[29]

Advances in wireless technology also hold great promise for the extension of global communications systems.[30] With wireless technology, service can be extended to countries and regions where the high costs of communication systems and/or unsuitable geographic terrain have historically stifled development. Equally important, developing countries can use wireless to "catch up" with the industrialized world. Having no sunk investment in outmoded systems, they can leapfrog directly to advanced telecommunication systems. Wireless technologies can also be used to upgrade existing wireline services.

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[25] Leslie Cauley, "Scientists Search for More Room on Phone Lines," *The Wall Street Journal*, Sept. 28, 1994, p. B7.

[26] Michael J. Mandel, "This Investment Boom Gives the Economy Running Room," *Business Week*, July 25, 1994, pp. 68–70.

[27] As described by Davis, Dinn, and Falconer, "Due to technology, the costs of transport for transatlantic cable systems has been going down dramatically ever since TAT-1 was installed in 1958. In today's equivalent dollars, each circuit in TAT-1 cost about $6 million. In 35 years, the equivalent cost of a transatlantic cable circuit has been reduced by a factor of 1,500." See, for a history and overview, John H. Davis, Neil F. Dinn, and Warren E. Falconer, "Technologies for Global Communication," *IEEE Communications Magazine*, October 1992, p. 38.

[28] AMERICAS-1 cable system is the first fiber-optic cable connecting Latin America, the Caribbean and the U.S. and is the world's first undersea application of optical-amplifier technology. Optical amplifiers increase the number of transmitted calls by boosting digital signals as they travel along the system, rather than electronically regenerating them. See IDB Worldcom Inaugurates Americas-1 Undersea Cable System," *Telecom Highlights International*, Wednesday, September 1994, p. 5.

[29] See, "(AT&T Corp.) Phone Concern's Unit, KDD Win Asia-Pacific Cable Pact," *The Wall Street Journal*, Oct. 4, 1994, p. A 15. See also "U.S. Big 3 Join in European Fiber-Optic Deal," *Telecom Highlights International*, Aug. 10, 1994, p. 4.

[30] Radio waves are the basic unit of wireless communicate. By varying the characteristics of a radio wave—frequency, amplitude, or phase—these waves can be made to communicate information of many types, including audio, video and data. Although the term "radio" is most commonly associated with commercial radio broadcasting services, it encompasses the entire range of wireless communication technologies and services, including television, microwave, radar, shortwave radio, mobile, and satellite communication. For a discussion of new developments in wireless technologies, see U.S. Congress, Office of Technology Assessment, *Wireless Technologies and the National Information Infrastructure*, OTA-ITC-622 (Washington, DC: U.S. Government Printing Office, August 1995).

TABLE 4-1: Capacity and Cost per Voice Path of Selected TransOceanic Cable Systems, 1956–2000

	Year in service	Cable system	Cost ($US) per voice path	Capacity (voice paths)
Trans-Atlantic	1956	TAT-1*	557,000	89
	1965	TAT-4*	365,000	138
	1970	TAT-5*	49,000	1,440
	1983	TAT-7*	23,000	8,400
	1988	TAT-8	9,000	37,800
	1989	PTAT	6,000	85,000
	1991	TAT-9	5,500	75,600
	1993	TAT-10	4,000	75,600
	1994	CANTAT-3	1,000	302,000
	1996–97	TAT-12/13	1,000	600,000
Trans-Pacific	1957	Hawaii 1*	378,000	91
	1964	TPC-1*	406,000	167
	1974	Hawaii 2*	41,000	1,690
	1975	TPC-2*	73,000	1,690
	1988	TPC-3*	16,000	37,800
	1991	North Pacific	5,000	85,000
	1992	Cable	5,500	75,600
	1996	TPC-4	2,000	605,000
		TPC-5/6		
Japan/Saudi Arabia/U.K.	1997	FLAG	1,500	605,000

*No longer in service.

Notes: Costs are capital and construction costs only, stated in US$ to the nearest $500, unadjusted for inflation. Current technology permits approximately five virtual voice paths to be derived from a digital channel operating at 64,000 bits per second (64 kbit/s). Fiber optic cables are expected to have a useful life of at least 25 years. Table reports average cost per voice path for cables with multiple landing points. For example, the TAT-9 system connects the United States and Canada with the United Kingdom, France, and Spain. The average U.S.-U.K. cost per voice path is approximately $4,000. Reserve capacity of cables is generally excluded.

SOURCE: Telegeography, 1994.

Since the launching of the first communication satellite—Hughes Early Bird—in 1965, satellite technology has played an important role in the transmission of information over long distances and to remote areas. Early satellites transmitted telephone calls across the Atlantic and Pacific Oceans and were used domestically to distribute network television programs. The range of satellite services has increased with each technological improvement. Today, systems are being developed that transmit information directly to end users and that support broadband communication services such as multimedia.

Satellites have proved especially useful in providing service to areas such as Eastern Europe and the former Soviet Union, where demand is much greater than existing infrastructure can handle. In 1994, five outlying Russian cities received telecommunications service through a combination of five new regional satellite earth stations and existing analog connections. By 1996, 25 cities throughout Russia will have regional earth stations and an additional 125 locations will be reachable by very small aperture terminal (VSAT).[31]

Given the geography of the region, satellite communications is also a logical choice for Latin American countries, where they have been in use since the late 1960s. Most countries in Latin America currently use PanAmSat and several Intelsat satellites to provide international voice, data, and imaging services for business. With the launch of the second-generation Brasilsat and

[31] "Russian Provider Gets $100M Boost," *CommunicationsWeek International,* July 18, 1994, p.1.

Mexican 30-band spacecraft later this year, more than 10 satellites will be available to meet the region's telecommunication needs.[32]

Satellite technology has also allowed the newly industrialized nations of the Pacific Rim to provide communication services at a pace commensurate with the vigorous growth of their economies. International high-speed, digital, private-line service, provided through Intelsat Business Service, was introduced in 1989 to link Japan and the United States. Carriers from Hong Kong, Japan, Malaysia, and Singapore quickly followed suit. With growth rates exceeding 50 percent, however, demand soon exceeded Intelsat's capacity, and domestic and regional satellites were required to fill the gap.[33] Japan has already launched a second domestic satellite, while South Korea, Malaysia, Thailand, and the Philippines have either committed to or are planning their own systems. A second wave of operators is also emerging to provide services in Asia, which includes Thaicom, PanAmSat, Apstar, Koreasat, Rimsat and Measat.[34] As competition among carriers becomes more intense, users benefit from specialized service offerings and discounted prices.

In Europe, satellites (along with cable technology) have been used primarily to support commercial broadcasting. During the period from 1988 to 1990, the number of European satellites increased from nine to 17, while the number of satellite channels increased from 67 to 138.[35] The Europeans have been much less inclined, however, to foster satellite usage for data and voice services. Satellite services are themselves still somewhat restricted.[36] And the European Telecommunications Standards Institute (ETSI) has been accused of delaying the development of a VSAT market. In 1993, there were about 1,600 two-way interactive VSAT terminals operating in Europe, with approximately 3,000 more on order; in contrast, in the United States, more than 50,000 such dishes had been installed by Hughes Network Systems, Inc., alone.[37]

Looking farther into the future, global networks based on the development of low earth orbiting satellites (LEO) offer great promise, allowing communication services to be relayed anywhere throughout the world. Low-earth orbiting satellites fall into two categories, "little LEOs" and "big LEOs."

The term little "LEOs" refers to systems that will use multiple small satellites to provide nonvoice, data messaging to fixed and mobile terminals on a potentially global basis. Little LEOs operate in frequencies below 1 gigahertz (in the very high frequency/ultra high frequency bands). These satellites are each expected to cost between $6 million and $10 million.[38] There are at present eight companies in the United States that propose to offer little LEOs using similar system architectures. If these systems are to provide services on a global basis, some international spectrum licensing issues must be resolved.[39]

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[32] Sylvia Ospina, "The Restructuring of a Region: Updating Latin American Communications," *Satellite Communications*, September 1994, p. 24.

[33] Ellen Hoff, "The Race is On: Asian Carriers Increasingly Must Adjust to Regional Competition," *CommunicationsWeek International*, Jan. 18, 1993.

[34] "Global Satellite Industry Alive and Well Says New Report," *Telecom Highlights International*, Sept. 7, 1994, pp. 16–17.

[35] Anton Lensen, *Concentration in the Media Industry: The European Community and Mass Media Regulation* (Washington, DC: Annenberg Washington Program, 1992), p. 8.

[36] Dawn Hayes, "Space Segment Still Out of Reach," *CommunicationsWeek International*, December 1991, p. 12; and Dawn Hayes, "Satcom Protest," *CommunicationsWeek International*, Dec. 16, 1991, p. 4.

[37] Andreas Evagora, "VSAT Advances Pitched in Europe," *CommunicationsWeek International*, Apr. 5, 1993, p. 23.

[38] For a more detailed discussion of this technology, see U.S. Congress, Office of Technology Assessment, *The 1992 World Administrative Radio Conference: Issues for U.S. Spectrum Policy—Background Paper*, OTA-BP-TCT-76 (Washington, DC: U.S. Government Printing Office, November 1991), p. 23.

[39] Ibid.

"Big LEOs" will operate in frequencies above 1 gigahertz. These systems can provide a wide range of global, or nearly global, mobile digital voice and data services. Applications include, for example, facsimile, paging, satellite-based news gathering, position location, search and rescue, disaster management, environmental monitoring, cargo tracking, and industrial monitoring and control services. Because these systems are larger and more complex than little LEOs, they are likely to be more expensive, costing on average $10 million to $20 million per satellite (see box 4-2 and box 4-3).[40]

On a more modest scale, microwave transmission can also be used to enhance global communication. Microwave has long been a mainstay in telecommunications network technology. Historically, its primary use was high-capacity, long-haul service, and it will continue to be important in such markets. Today microwave provides about one-third of all worldwide transmission capacity. Although there may be limited prospects for this technology in advanced industrial countries, where technology options abound, a growing market is predicted in developing countries where costs are high and alternatives few.[41]

One of microwave's advantages is its relatively low construction costs for rural applications compared to other technologies. Unlike terrestrial wireline technologies, it does not require replacement of physical cable plant, usually the highest component of development costs. Rooftops, hills, and mountains often provide an inexpensive base for microwave towers. Unit costs of microwave service are also falling, as more high-powered systems expand the usable spectrum. Very small capacity systems with only a handful of circuits are also now available. Recently, firms such as Alcatel and Northern Telecom have adapted microwave for use in high speed networks. One major disadvantage of microwave is that it requires line-of-sight of the transmission path. A second is that microwave is subject to electromagnetic interference.

The Role of Interconnection

Some technologies, such as satellite, are inherently global in scope, but other technologies can be used to provide global service if interconnected on a world-wide basis. Cellular radio is a particularly promising technology in this regard, given its rapid growth in markets throughout the world. According to the International Telecommunications Union (ITU), subscribership to global cellular systems grew by 47 percent in 1993, totaling 43 million. This growth rate far outpaced the 5 percent growth reported for fixed-line telephone subscriptions. The number of cellular subscribers in developing countries rose from just under 3.5 million in 1992 to over 5.3 million in 1993. This number is expected to increase to 26 million by the end of the decade.[42]

If cellular is to fully support global service, however, there will probably need to be greater consensus on international standards. Although Europe has settled on the GSM (Global System for Mobile Communication) standard, U.S. providers have been unable to agree on one of two competing standards.[43] The situation might improve in the future, however, given considerable momentum in support of the European standard. Europe will itself have a sizable market for cellular, increasing from $6.07 billion in 1991 to $14.44 in 1996. Countries outside Europe that have committed to GSM include Australia, Hong

[40] Andrease Evagora, op. cit., footnote 37.

[41] C. Bruce Page, "Microwave Vendors Gear Up for New Growth," *Re: Transmission*, Apr. 6, 1992, pp. 10–11.

[42] Newsletter of the ITU, July, 1994, pp. 21–23.

[43] The U.S. Cellular Telecommunications Industry Association originally came out in support of time division multiple access (TDMA). However, six of the Bell Regional Operating Companies have been conducting trials using code division multiple access (CDMA), a technology that was first developed in the military, but which is now being adapted for civilian use by Qualcomm Inc. See Andreas Evagora, "Common Mobile Components Sought," *CommunicationsWeek International*, Mar. 2, 1992, pp. 1, 6; Tom Crawford, "Why CDMA Should Be the Choice for Digital Cellular Carriers," *Telecommunications*, March 1993, pp. 49-51; and John Williamson, "Bids for Global Recognition in a Crowded Cellular World," *Telephony*, Apr. 6, 1992, pp. 37–40.

BOX 4-2: Big Low Earth-Orbiting Satellites (LEOS)

A new generation of mobile satellite service (MSS) systems called Big LEOS (low earth-orbiting satellites) is in development stages to provide mobile telephone service to nearly any point on earth. The proposed "Big LEO" MSS systems, though not yet in use, received international frequency allocations at the 1992 World Administrative Radio Conference. More recently, on January 31, 1995, the Federal Communications Commission (FCC) granted licenses to three of five U.S.-based applicants who sought approval to deploy MSS systems: 1) Motorola Satellite Communications, Inc.'s *Iridium;* 2) Loral/Qualcomm L.P.'s *Globalstar;* and 3) TRW, Inc.'s *Odyssey*. TRW's *Odyssey* system actually proposes to use 12 satellites in medium earth orbit or 10,354 km above the earth. Motorola's *Iridium* system proposes 66 satellites at 770 km and Loral/Qualcomm's *Globalstar* system proposes 48 satellites at 1,401 km. A fourth organization, the London-based International Maritime Satellite Organization (INMARSAT), also plans to deploy a medium earth-orbiting MSS system through a separate affiliate called ICO Global Communications, Ltd.[1] These system developers are hoping to initiate services as early as 1998 to a market that could reach 5 million to 10 million users worldwide by early in the next century.

Services

All three MSS systems licensed by the FCC in January 1995 seek to provide global, or nearly global, mobile digital voice and data services, including cellular-like telephone services and data transmission for applications such as facsimile, paging, satellite-based news gathering, position location, search and rescue, disaster management, environmental monitoring, cargo tracking and industrial monitoring and control services. Systems under development would provide service to and from mobile and hand-held terminals in addition to fixed locations. The market for such anytime anywhere services is expected to include international tourists and business travelers, emergency relief organizations and government officials. If deployed, these systems will have a relatively low incremental cost per call, and so system operators may be in a position to make a limited amount of capacity available at low prices for use in underserved regions of the world. Fixed terminals could also be deployed for shared use in developing countries where mail line telephone density is sometimes less than one for every 100 people. Handset costs are expected to range from $500 to $3,000 with service costing anywhere from $.40 to $3.00 per minute in addition to monthly service charges.

Technology

Big LEO systems operate in frequencies above 1 GHz and employ orbital locations between 500 and 1,400 km. By employing satellites in low earth orbit, these systems have the potential to alleviate the delay in conversations characterized by voice transmitted over geosynchronous satellites which are up to 60 times higher in the sky. The LEOs are also expected to be less costly to manufacture and easier to deploy.

The proposed systems differ both in the number and arrangement of satellites but employ similar strategies for call completion. All four systems use "dual mode" handsets, which facilitate transmission via both terrestrial cellular networks and the satellite constellation. A call initiated from a handset would first seek transmission over the local cellular network for connection to the wireline network. Calls originated in areas outside the reach of cellular would be transmitted up to the satellite and relayed back to a ground station from which the call would be routed over the public switched network. Motorola's *Iridium* system is unique in its plans to incorporate intra-satellite transmission links which would make possible direct transmission from one *Iridium* handset to another. Satellite-to-satellite transmission requires more sophisticated, and thus more costly, satellites than the "bent-pipe" style satellites employed by *Globalstar, Odyssey* and *Inmarsat-P.* These satellites relay traffic from ground terminals directly to the nearest gateway.

(continued)

BOX 4-2: Big Low Earth-Orbiting Satellites (LEOS (Cont'd.))

A key characteristic of all three systems licensed by the FCC is the method chosen to ensure that multiple users may simultaneously access the same satellite. TRW's *Odyssey* system and Loral Qualcomm's *Globalstar* system both use code division multiple access (CDMA) to achieve this goal. CDMA allocates each user the same band in its entirety on a continuous basis. Interference is avoided by assigning each user a unique spreading code for spreading his/her signal to fill the band. The *Iridium* system uses time division multiple access (TDMA), which allocates to each user a different *time* to transmit. Digital techniques have refined this technique so that turns can be taken so quickly that it appears to each user that he has a full-time channel. Finally, all Big LEO systems employ at least two satellite-tracking stations to monitor satellite functioning and orbital location.

[1] For a description of each of these four MSS systems, see box 4-3. The FCC did not grant licenses for the MSS systems proposed by Mobile Communications Holdings, Inc. and Constellation Communications. Two entities, Personal Communications Satellite Corporation and Celsat, Inc., have applied to construct geostationary MSS systems in the 2 GHz MSS allocations.
SOURCE: Office of Technology Assessment, 1995.

Kong, Hungary, India, Russia, Singapore, and the United Arab Emirates. Also favoring the European standard are Brazil, Columbia, Iran and New Zealand.[44]

With the evolution of more advanced terrestrial based services such as personal communication systems (PCS) and future public land mobile telecommunications systems (FPLMTS), care will be needed to assure that the interoperability problems that have been associated with GSM are not replayed.[45] Interoperability is still possible, but by no means certain.[46]

Standard setting has suffered from the slow and arduous process of consensus building, which has typically failed to keep pace with rapid advances in communication technologies. To encourage agreement, make allowances for technology change, and facilitate interoperability among an increasing number of interdependent parties, networking standards are often incorporated in elaborate reference models and defined in overly broad and generic terms.[47] Thus, even after standards have been formally set, users still have had to specify the particular uses to which these standards will be applied; vendors have to implement compatible technologies that meet standards and specifications; and products need to be certified as to their compatibility with one another.[48] The process can be so complex and time consuming that the window of opportunity

[44] Karen Lynch, "U.S. Seen Losing Cellular Advantage," *TelecommumnicationsWeek International*, Mar. 22, 1993, p. 44; See also Mark Newman, "GSM Takes on the World," *TelecommunicationsWeek International*, Oct. 2, 1994, pp. 1, 60.

[45] Still in the concept phase, future public land mobile telecommunication systems is seen by the Europeans to be the successor to GSM. As presently conceived, it would consist of a terrestrially based system (perhaps supplemented by satellite technology) using large towers located throughout a region to provide an array of voice, data, and video services to mobile users. The United States has remained somewhat skeptical of this technology, on the grounds that clear service definitions and specifications have yet to be developed. Instead, the United States has concentrated on the development of personal communication systems (PCS). OTA, *The 1992 World Administrative Conference*, op. cit., footnote 39, p. 77.

[46] Although the United States and the Europeans disagreed at the World Administrative Radio Conference (WARC)-92 about bandwidth allocation for FPLMTS, the (Federal Communications Commission) FCC has recently proposed to allocate PCS bandwidth that falls, to a considerable degree, in the same range of spectrum as that allocated at World Administrative Radio Conference (WARC) to FPLMTS. Thus, even if the U.S. and Europe pursue different technologies, a FCC decision such as this would still allow for a viable, worldwide mobile communication system. Ibid.

[47] These standards are referred to as anticipatory standards because the process of setting standards anticipates the creation of the product. For a discussion, see Carl F. Cargill, *Information Technology Standardization: Theory, Process and Organizations* (Cambridge, MA: Digital Press, 1989).

[48] Ibid.

BOX 4-3: Four Proposed "Big LEO" Satellite Systems

***Iridium:* Motorola Satellite Communications, Inc.**

The *Iridium* system plans a constellation of 66 low earth-orbit satellites (LEOS) arranged in six different planes and 15 to 20 earth-based gateways. *Iridium* is unique in its plans to employ satellite-to-satellite crosslinks at 25 Mbps which would circumvent the need to downlink voice and data to intervening hubs. The satellites will travel longitudinally, ringing the planet from pole to pole, at an altitude of 770 km. System capacity is 3,840 full duplex circuits/satellite which would support transmission rates for voice and data of 4.8 kbps and 2.4 kbps respectively. Three tracking stations will track *Iridium* satellites and monitor battery life, temperature and transponder status.

The cost to construct, launch and operate *Iridium* for one year after the launch of the first satellite is expected to be $3.759 billion. As of February 1995, investments in *Iridium* totaled $1.57 billion. Motorola, Inc., is the largest investor with 27 percent of Iridium Inc.'s stock. *Iridium's* second largest investor is a consortium of 17 Japanese companies that invested about $235 million led by DDI Corporation, Japan's second-largest telecommunications company. Other investors include: Vebacom GmbH, the German energy conglomerate Veba AG's telecommunications arm; Korea Mobile; Sprint; STET, Italy's PTT; Bell Canada; Raytheon; Lockheed; and other participants from North and South America, Europe, and Asia.

Iridium handsets are expected to cost as much as $3,000 with calls costing approximately $3 per minute. Motorola approved the project in June of 1990 and in August 1992, Iridium received an experimental license to construct and launch an initial network of five satellites. The license granted to *Iridium* on January 31, like those granted to *Globalstar* and *Odyssey,* gives Motorola the authority to construct, at its own risk, a system capable of operating in the feeder link frequency bands they requested, but not the authority to operate in those bands.[1] Satellite construction is already under way and *Iridium, Inc.* has said it intends to begin satellite launch by January, 1997. Commercial service is expected to become available in 1998.

***Globalstar:* Loral Qualcomm Satellite Services, Inc.**

The *Globalstar* system would have a network of 48 satellites equally divided into eight orbital planes that would orbit the earth at an altitude of 1,401 km. Satellites would be "bent pipe" style and possess a 1,500-mile-wide footprint to provide "global" coverage between 70 degrees latitude north and south. System capacity would be 2,800 full duplex circuits/satellite, which would support transmission rates for voice and data of between 1.2 kbps and 9.6 kbps depending upon channel conditions.

The cost to construct, launch, and operate *Globalstar* for one year is expected to be $1.554 billion. Globalstar, L.P., an international partnership founded by Loral Corp. and Qualcomm, Inc., invested $275 million in an initial financing round in March 1994. An initial public offering in February 1995 raised an additional $188 million, bringing total funds to $492 million. Investors include AirTouch Communications, Inc.; Alcatel N.V. and France Telecom of France; Vodafond plc of the United Kingdom; DACOM Corp. and Hyundai Electronics Industries Co. Ltd. of South Korea; Daimler Benz Aerospace AG of Germany; Finmeccanica of Italy; and the international Space Systems/Loral aerospace consortium.

Globalstar handsets are expected to cost $700 with calls costing approximately 40 cents per minute plus a monthly service charge of between $8 and $10. Globalstar plans to begin launching satellites in the second half of 1997 with service to begin in 1998.

(continued)

BOX 4-3: Four Proposed "Big LEO" Satellite Systems (Cont'd.)

***Odyssey:* TRW, Inc. and Teleglobe**

The *Odyssey* system proposes 12 medium earth-orbit satellites, equally divided into three orbital planes at an altitude of 10,354 kilometers and 10 to 11 earth stations. Like *Globalstar* and *Inmarsat-P, Odyssey*'s satellites would be "bent-pipe" style and so would not utilize inter-satellite transmission. System capacity is 2,300 full duplex circuits/satellite which would support transmission rates of 4.8 kbps for voice and between 1.2 kps and 9.6 kbps for data. Satellite lifetime is projected at 10 years.

TRW, Inc. estimates the cost to construct, launch, and operate the system for one year at $1.8 billion. Teleglobe and TRW will provide 5 percent and 10 percent of the equity, respectively. They are seeking financing for the remaining eighty-five percent, most of which is expected to be in equity and the balance a combination of debt and vendor financing. TRW said it has sufficient current assets and operating income to finance the project and submitted a declaration from its CFO during the licensing process committing TRW to expend the funds necessary to construct, launch, and operate the *Odyssey* system.

Odyssey handsets are expected to cost less than $500 with calls costing 75 cents per minute plus a monthly service charge of $24. Satellite launch is scheduled to begin in the third quarter of 1998. TRW expects the system to become operational by the end of 1998 with six satellites giving single-satellite service to selected regions. Full constellation deployment is envisioned by the end of 1999.

***Inmarsat-P:* ICO Global Communications Limited (consortium including Inmarsat and 38 Inmarsat signatories)**

Inmarsat-P, sometimes referred to as *Project-21,* would employ 10 or 12 satellites in intermediate circular orbits (10,355 km). Each satellite would have the capacity for 4,000 circuits and an expected lifetime of 10 years.

The cost to construct, launch, and operate the system for one year is expected to be $2.8 billion. About $1.4 billion in initial financing was committed by 39 signatories to Inmarsat including a commitment of $150 million by Inmarsat as an organization. The Inmarsat Council has indicated that Inmarsat and its affiliates will maintain at least 70 percent ownership. Additional pledges of $900 million were turned away and the remaining $1.4 billion will be financed through equity and debt. The U.S. investor is Comsat Corp., the U.S. government's representative in international satellite treaties. In Europe, the biggest investors are Deutsche Telekom AG's mobile-phone unit and the Swiss, Spanish and Dutch state phone companies. Other major investors are: the Beijing Maritime & Shipping Co., an arm of the Chinese Ministry of Transport; Japan's main international phone carrier, KDD, Ltd.; India's international phone company; and Singapore Telecom Pty.

Inmarsat handsets are expected to cost between $1,000 to $1,500 with calls costing $2 per minute. *Inmarsat* has started the licensing process in the United Kingdom and hopes to begin offering service in 1999 with the system fully operational by the year 2000.

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[1] The Federal Communications Commission (FCC) *did not* award unconditional authorization to any of the three systems licensed on January 31 for specific feeder link frequencies, that is frequencies for transmission links between the satellites and gateway earth stations. Some of the feeder link frequencies are currently allocated to other services and require allocation action at an International Telecommunications Union World Radio Conference, or are being considered for uses other than satellite services domestically, in other Commission proceedings. "International Bureau Grants Three Licenses for 'Big LEO' Satellite systems." Jan. 31, 1995, FCC News Release.

SOURCE: Office of Technology Assessment, 1995.

sometimes closes and those standards are overtaken by new technologies and events (see box 4-4).

Discouraged by the lagging process, many vendors and users have begun to circumvent the traditional standards-setting process by developing standards consortia.[49] Operating in a relatively closed environment, these groups have greatly simplified the standards process. Membership is generally restricted, and fees can reach as high as $650,000 per year.[50] Given such exclusivity, consortia often replicate the dynamics of the market. Instead of consensus, they can lead to competing vendor alliances, each supporting a different standards. In such cases, consortia may serve to reduce the total number of technology alternatives, but they offer little in terms of developing open systems.

Nowhere have the benefits of interconnection been more vividly illustrated than in the case of the Internet, which, as described in chapter 3, has been growing globally and at a phenomenal rate. The Internet is a global computer network that provides technical compatibility and transparent connectivity based on a widely used suite of protocols, TCP/IP. Like the Internet itself, Internet standards evolved in a very informal way as part of the efforts of the Defense Advanced Research Projects Agency (DARPA) in 1969, with funds from both the Department of Defense and the National Science Foundation, to establish computer networks linking researchers across the country. The original participants were few, and they were bound together by a common research purpose. Thus, despite rapid network growth, the Internet standards setting body—the Internet Engineering Task Force (IETF)—has been able to hold to its tradition of openness and inclusively. Conducted for the most part online, this open process has not occurred at the expense of timeliness. Today, the Internet is the forerunner of a truly global information network with over five million host computers providing full TCP/IP connectivity to more than 90 countries around the world.

Its success notwithstanding, in terms of global connectivity, the Internet should be viewed as the exception rather than the rule. Other technologies and applications have been slow to take off on a global basis because of inconsistencies in standards and technology deployment. Thus, for example, although the demand for electronic data interchange (EDI) is rapidly growing, the international EDI market barely exists at present.[51] This delay is due in part to the fact that, while the United States has adopted the ANSI x.12 standard for EDI, most of the rest of the world is using EDIFACT.[52] In Asia, the biggest standards barrier to the use of EDI is one of language.[53]

The Need for a Consistent Technology Base

For networks to interconnect, they must also be comparable in terms of quality, and the types of service offered. Thus, one finds, for example, that the worldwide deployment of integrated services digital networks (ISDN) has suffered not only from a lack of interoperablity but also from the lack of a ubiquitous and consistent technology base. To understand the problem, one need only consider the situation in Europe where, despite a common communication policy set out

[49] Vendor consortia have been established, for example, to set standards for switched multimegabit data service (SMDA), fiber distributed data interface (FDDI) over twisted pair, asynchronous transfer mode (ATM), and frame relay technologies. For a discussion, see Martin Weiss and Carl Cargill, "Consortia in the Standards Development Process," *Journal of the American Society for Information Science*, September 1992, vol. 43, No. 8, pp. 559–565.

[50] Ibid.

[51] The European EDI service market generated $100 million in revenue in 1991, and is predicted to reach $500 million in 1996. The North American EDI market, which suffers from less fragmentation, is expected to reach $1.5 billion by 1998. See Donne Pinsky, "AT&T, BT, and IBM Connect Euro Edi," *CommunicationsWeek International*, Oct. 19, 1992, p. 48.

[52] Alice LaPlante, "Handling Standards That Aren't Standard," *Computer World*, Apr. 13, 1990, p. 80.

[53] Paul Kimberley, "EDI: Status in the Asia-Pacific Region," *Telecommunications [International Edition]*, vol. 1, n. 28, January, 1994, pp. 39–48.

BOX 4-4: Integrated Services Digital Network (ISDN)

ISDN is a public switched service that allows the digital transport of voice, data, and image communication over a single network. Although originally lauded for its ability to provide advanced services on a ubiquitous basis over the public network, its prospects seem much less promising today. After 10 years of development, ISDN has yet to be widely deployed.

ISDN's poor showing is the result, in part, of ineffective marketing, regulatory barriers, and poor pricing. However, these problems might have been more easily overcome had it not been for the problem of interoperability. Like all networking technologies, ISDN required a critical mass for the market to take off, but such a market could only develop if vendors' systems could interconnect. Given the competitive environment, however, the momentum to create the requisite standards for interconnection was lacking.

Notwithstanding years of considerable effort to develop ISDN standards, vendors continued to create products that, although they were said to conform to these standards, were incompatible. Even when AT&T, Northern Telecom Inc., and Siemens Stromberg-Carlson agreed to modify their switches to conform to a single standard, the Regional Bell Operating Companies (RBOCs) continued to deploy ISDN at varying rates. Even Bellcore's effort, ISDN1—which sought to produce a standard basic rate interface protocol—was a disappointment. Within a week of Transcontinental ISDN Project Trip 92, a major industry-sponsored event designed to demonstrate coast-to-coast interoperability, two RBOCs—Southwestern Bell and U.S. West—announced that they would not, in fact, adhere to the new standard.

SOURCE: Office of Technology Assessment, 1995.

by the European Union (EU), which calls for harmonization, ISDN deployment varies greatly. Whereas in France, deployment has reached almost 100 percent, in countries such as Greece, it is virtually nonexistent.[54] Spotty interconnection discourages usage, and hence further deployment.

Frame relay technology has experienced a similar fate. Many multinational corporations would use frame relay as a networking technology if it were available in more than a few major cities. In February 1993, Finland was the only country in Europe where a public frame relay-service was available. Although customized services are available from public network providers, the costs are prohibitive for most companies. Frame relay also suffers from interoperability problems, since unlike x.25 packet switching, frame-relay networks use different trunking protocols.[55]

Institutional Barriers to Global Deployment

Interconnection problems are not just technical in nature; more often than not they involve institutional arrangements. Institutional arrangements are critical because, if global communication systems are to be truly seamless, they require not only common standards and interfaces but also common rules of access and pricing. Achieving such commonality can be very difficult, however, given that rules of interconnection reflect both national social and economic goals as well as communication policies.

[54] As described by the European telecom manager for Westinghouse Communication Systems, "It is not always easy to match up ISDN in the United States with ISDN in Europe... And in countries where we need it most like Spain, ISDN is just not available." Cited in Terry Sweeney, "Mix and Match Networks," *CommunicationsWeek International,* Apr. 5, 1993.

[55] David Yuen and Bob Reinhold, "Frame Relay Faces National Boundary," *Network World,* Apr. 13, 1992, pp. 17–18; and Donne Pinsky, "So Close Yet So Far," *CommunicationsWeek International,* Jan. 18, 1993, p. 3.

Rules of interconnection establish the basis on which public network operators allow other providers to access the public network and determine the prices that are charged for such access. If communication systems are to be truly global, comparable rules of interconnection need to be consistently, and transparently, applied. Interconnection rules are required, moreover, not only for providers from different countries, but also for different kinds of providers within each country. For example, there need to be rules governing the relationship between public and private networks, between value-added data services and public networks, and between providers of public voice telephone services whether they are fixed or mobile.[56]

Establishing interconnection procedures was relatively easy in the past, when there were fewer types of services, and when providers were modeled after one another, assuming for the most part the form of the classic PTT. Such uniformity no longer exists today.[57] National communication systems now differ significantly, depending on the extent to which they are government owned or operated, monopoly based or liberalized, and/or regulated or not regulated.[58] At one end of the scale are countries such as the United States, New Zealand, Great Britain, Japan, Singapore, Malaysia, and Mexico, which are striving to minimize government involvement. At the other end are countries such as China, Brazil, Venezuela, and Uruguay, where the legacy of the traditional PTT is very strong.[59] Discrepancies in rules for interconnection reflect these basic organizational and, at bottom, philosophical differences.

Globalization Measured in Terms of Worldwide Trade and Provisioning of Services

Viewing global networking from the perspective of ubiquity and universality, globalization still appears a long way off, with many barriers yet to be overcome. On the other hand, if instead the term global communication is used to refer to the transcending of national boundaries, then the evidence points much further in the other direction. Moreover, there are a number of developments driving this trend toward globalization, including among them an increase in the demand for worldwide service; the growth in world-wide trade and the development of a worldwide market; the privatization and commercialization of the telecommunications sector; and the emergence of global service providers.

The Growing Demand for Worldwide Services

The provisioning of communication products and services on a world-wide basis both mirrors and serves to drive the broader trend toward the development of a global economy. This global economy is characterized by the emergence of economic actors who buy and sell their products and provide services world-wide. Equally, if not more important, they establish their base of operations on a transnational basis, allocating all their activities among a number of countries to gain the optimum advantage.[60] When not fully integrated into multinational corporations, these firms are networking their activities across global boundaries through a variety of alliances and arrangements such as cross licensing of technology, joint ventures, orderly marketing agreements, offshore production of components,

[56] Grahm Finnie, "Interconnect: New Operators Plug In," *CommunicationsWeek International*, Mar. 16, 1992, p. 18.
[57] See Mehreroo Jussawalla (ed.), *Global Communication Policies: The Challenge of Change* (Boulder, CO: Westview Press, 1992), p. 4.
[58] Colin D. Long, "Interconnection in Europe: The Legal and Regulatory Dimension," *Telecommunications Policy*, July 1991, pp. 95–98.
[59] Stephen McClelland, "The International Dimension: PTTs," *Telecommunications Policy*, June 1992, pp. 31–37.
[60] Thus depending on the particular case, it might be best for a firm to disperse many of its production facilities—such as design modification, fabrication and assembly—to foreign countries, and to focus its own domestic production on the fabrication of key components. Or, alternatively, a firm might decide to manufacture a product domestically, but transfer abroad such downstream activities as distribution, sales, marketing, and service. See Michael Porter (ed.), *Competition in Global Industries* (Boston, MA: Harvard Business School Press, 1986).

secondary sourcing, and crosscutting equity ownership.[61]

As companies spread their corporate boundaries, they must have access to advanced telecommunication products and services that can span the globe. Transnational corporations, for example, must operate on a real time basis in response to their rapidly changing environment. Moreover, they must be able to balance their global operations with the requirements of local markets—such as the need to establish special marketing channels, service contracts, and work relationships. To function as a single unit, they must be able to apply information and knowledge to an ever growing number of complex business problems, as well as to share and leverage these resources both within and across organizational and national boundaries. For these purposes, seamless worldwide networking technologies, which can support applications such as electronic data interchange, computer integrated manufacturing, databases for information management, videoconferencing as well as other kinds of groupware, will be critical.

In developing such global strategies, businesses have benefited from major reductions in the cost of buying international communication services. In 1970, for example, a firm had to pay approximately $8,000 to $9,000 per month to lease a single voice-grade channel. Today, it is possible to lease a 64kbps line, which provides eight times the transmission capacity for approximately $6,000 per month. Declining prices stem not only from technology advances such as fiber optics; equally, if not more, important has been the growth of international competition. With the pressures toward liberalization and the privatization of many telecommunication regimes (as described below), this competition will become even more intense in the future, continuing to force prices down and demand up.[62]

Increased competition and growth in worldwide demand is also due to the emergence of new suppliers and the development of new kinds of products and services that are based on the convergence of communication technologies. Included among these, for example, are systems integration; 24-hour commodity trading, payments, and settlements; credit authorization; and computerized reservation systems.[63] Greater competition and many more such services can be expected in the future, because the barriers to entry are relatively low. Often, all that is required is software and a computer-network link.

Consider, for instance, telecommunication discount companies, such as International Discount Telecommunications (IDT). Capitalizing on the gap between U.S. telecommunication prices and prices in other, less deregulated, countries, IDT uses computerized switches in the United States to reroute calls from foreign subscribers. These companies undercut their competitors' rates by as much as one-third.[64] Similarly, the small but rapidly growing telecommunication services company Viatel sells software-based value-added services to small and

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[61] See Peter Cowhey and John Aronson, *Managing the World Economy: The Consequences of Corporate Alliances* (New York, NY: Council on Foreign Relations, 1993); See also, David Lei and John W. Slocum, Jr., "Global Strategy, Competence Building and Strategic Alliances," *California Management Review*, fall, 1922, pp. 81–97. Once generally associated with U.S. industries, multinationals are, themselves, increasingly becoming global in nature. For example, globally networked Japanese and European firms, while differing somewhat in style from U.S. firms, have significantly grown in number in the course of the past decade. See Bruce Kogut, Weijian Shan, and Gordon Waler, "Knowledge in the Network and the Network as Knowledge," in Gernot Grabher, *The Embedded Firm: On the Socioeconomics of Industrial Networks* (London, UK: Routeledge, 1993), p. 90.

[62] Karen Lynch, "Global Services Showdown: Communications and Computer Companies Jockey to Redefine Themselves as International Service Providers," *CommunicationsWeek International*, May 11, 1992, p. 22.

[63] Bruno Lanvin, "Information Technology and International Trade," in Bruno Lanvin (ed.), *Trading in a New World Order: The Impact of Telecommunications and Data Services on International Trade in Services* (Boulder, CO: Westview Press, 1992, p. 4; see also Office of Technology Assessment, *U.S. Telecommunication Services in European Markets* (Washington, DC: U.S. Government Printing Office, August 1993).

[64] Meheroo Jussawalla, "Introduction," in Meheroo Jussawalla (ed.) footnote 57, op. cit., p. 4.

medium-sized businesses in Latin America and Western Europe.[65]

The demand for global networking services has also been spurred on by the growing complexity of the worldwide marketplace. Given a multitude of available services and service providers, divergent standards and levels of technology deployment, as well as differing national languages, rules, and regulations, many businesses are finding that it is more cost-effective to "outsource" the management of their international networks on a contract basis.[66] Thus, for example, J.P. Morgan & Co. has contracted with BT North America to handle all of its overseas, terminal-to-host networks, at a cost of $20 million. Similarly, BT North America has contracted with Gillette Co. to manage its telecommunications operations in 180 countries. AT&T also provides virtual private network services on a global basis. For example, AT&T is currently providing the network linkages for GE in 16 different countries.[67]

The Growth in Worldwide Trade

The growth in worldwide trade in telecommunications and information-based networking services attests to the demand for more versatile products and seamless worldwide services.[68] Communications is, today, one of the fastest growing sectors in the international market, with expansion over the past decade outstripping growth in GNP.[69] In 1990, the market for international calls totaled $50 billion.[70] In 1990, the world market in telecommunication equipment and services was estimated at $370 billion, growing to $400 billion in 1991 and 1992, despite the world recession. Estimated annual growth rates in the telecommunications market ranged between 10 to 15 percent.[71]

Spending on information technologies has remained closely aligned with spending on communication technologies—a fact that bears witness to the growing convergence of these technologies. Excluding telecommunication hardware and services as well as information services, world-wide spending on information technology totaled $305 billion in 1990. Growth in this sector was approximately 12 percent between 1989 and 1990, with software contributing the greatest proportion with a growth rate of 17 percent.[72]

Globalization is also evidenced by the growing percentage of national revenue that is derived from international offerings. According to one account, for example, 16.3 percent of worldwide value-added services revenue stemmed from international offerings in 1990. Estimates are that this figure will increase to 28 percent by 1996.[73]

This international growth potential is especially important for countries such as the United States, where the domestic market for many products and services is rapidly becoming saturated (see tables 4-2 and 4-3). The European market for value-added services, for example, is

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[65] See, "Soros Makes Investment in Viatel," *Telecom Highlights International*, vol. 15, No. 41, Oct. 13, 1993, p. 5.

[66] Rita Das, Kenneth E. Ferrere, and Douglas P. Macbeth, "Global Networks—The Easy Way," *AT&T Technology: Products, Systems and Services*, No. 4, 1993, p. 10.

[67] Ibid.

[68] OTA, U.S. *Telecommunication Services in European Markets*, op. cit., footnote 65.

[69] "Telecommunications Is the Measure of Economic Growth," *Telecommunications Highlights International*, vol. 15, No. 49, Oct. 6, 1992, p. 2.

[70] Gary C. Staple (ed.), *Telegeography 1992: Global Telecommunications Traffic Statistics and Commentary* (Washington, DC: International Institute of Communications, 1992).

[71] An FCC report, *Preliminary 1993 Section 43.61 International Telecommunication Data*, reported that U.S. customers spent about $12.0 billion for international services in 1993, an increase over the previous year of $1.2 billion. In 1993, U.S. customers made a total number of calls equaling 1.9 billion, while those received were 1.2 billion. According to the FCC report, U.S. carriers supplied 14,172 private line circuits between the United States and international points in 1993. See, "FCC Released International Traffic Data," *Telecom Highlights International*, Oct. 12, 1994, p. 8.

[72] *Information Technology Outlook 1992* (Paris, France: OECD, 1992), pp. 6–7.

[73] Karen Lynch, "Global Service Showdown: Communications and Computer Companies Jockey To Redefine Themselves as International Service Providers," *CommunicationsWeek International*, May 11, 1992, p. 22.

Rank	Company	International communications revenue ($m 1993)	Total revenue ($m 1993)	Income before taxes ($m 1993)	Employees (1993)	Employment change (1992–93)	Outgoing MITT (m 1993)[1]	State ownership
1	AT&T (U.S)	8,976[Y]	39,863[2]	6,204	308,700[3]	-1%	7,235[T]	0%
2	DBP Telekom (Germany)	5,534[Y]	35,679	1,934	231,000	0%	4,880[T]	100%
3	Cable & Wireless (U.K.)	3,425	7,058	1,634	41,348	+4%	NA	0%
4	France Telecom (France)	3,364	22,426	3,527	154,548	-1%	2,751	100%
5	BT (U.K.)	2,944	20,540	4,140	156,000	-9%	2,301	0%
6	MCI (U.S.)	2,772[Y]	11,921	1,045	36,235	+17%	2,839 [T]	0%
7	KDD (Japan)	2,159	2,159	299	5,772	-2%	952 [T]	0%
8	Telmex (Mexico)	1,557	7,898	3,301	48,771	0%	625 [T]	0%
9	Stentor (Canada)[4]	1,525	10,852	NA	88,500	-9%	1,669	3%
10	PTT Telecom (Netherlands)	1,464[Y]	6,370	1,441	34,359	-2%	1,236	100%
11	Telstra (Australia)	1,190[Y]	9,089	1,719	65,200	-5%	640[T]	100%
12	Sprint (U.S.)	1,188Y	11,368	776	50,000	0%	1,181	0%
13	Swiss PTT (Switzerland)	1,184Y	6,392	519	20,521	-2%	1,572	100%
14	Telefonica (Spain)	1,043	9,587	844	74,340	0%	802	32%
15	Teleglobe (Canada)	975	1,110	89	2,128	+2%	808	0%
16	Singapore Telecom (Singapore)	968	1,975	937	10,937	+1%	480	89%
17	Iritel (Italy)5	935	1,436	NA	NA	NA	1,190	100%
18	Embratel (Brazil)	899	4,736	388	12,083	+2%	164	100%
19	DGT (Taiwan)	824	4,496	799	NA	NA	441T	100%
20	Telia (Sweden)	705	4,541	508	34,090	-18%	685	100%

(continued)

TABLE 4-2: Top 25 International Telecommunications Carriers (Cont'd.)

21	OPT (Austria)6	688Y	4,824	250	55,194	0%	767	100%
22	VSNL (India)	665	665	81	NA	NA	284T	85%
23	Belgacom (Belgium)	641	3,207	353	25,643	-6%	979	100%
24	Bezeq (Israel)	623	1,769	172	9,878	-1%	176T	76%
25	Korea Telecom (South Korea)	598Y	6,205	1,095	NA	NA	265T	98%

Notes: Figures for 1993 fiscal year. Figures for Japanese, U.K., Australian carriers aare for year ended 31 March 1994. Figures for KDD are for year ended 31 March 1993. Figures converted to U.S. dollars at 1993 average exchange rates. Domestic operators excluded from ranking. NA=not available.

[Y]Yankee Group estimates.

[T]Estimates by TeleGeography Inc., Washington.

[1]Minutes of international telecommunications traffic.

[2]Excludes product revenues.

[3]T&T employee figures include equipment manufacturing.

[4]International services to U.S. only.

[5]International services to European countries.

[6]OPT Austria figures include postal and bus services.

SOURCE: The Yankee Group Europe, Watford, England.

TABLE 4-3: Top 15 Communications Equipment Manufacturers

Rank 93	92	Company	Communications equipment revenue ($m 1993)[1]	Total revenue ($m 1993)	Change in total revenue (1992–93)	Income before taxes ($m 1993)	Change in income (1992–93)	Employees (1993)	Total revenue per employee	Main communications products
1	1	Alcatel Alsthom (France)	14,544	27,605	-3.3%	1,582	-7.4%	196,500	140,485	Public, private network systems
2	2	Siemens (Germany)	11,986	49,385	+4.0%	1,761	-8.9%	391,000	126,304	Public, private network systems
3	3	AT&T (U.S.)	11,783	67,156	+3.5%	6,202	+4.1%	308,700	217,545	Public, private network systems
4	4	Motorola (U.S.)	10,105	16,963	+28%	1,525	+91%	120,000	141,358	Mobile, data communications products
5	7	NEC (Japan)	8,714	32,192	+1.8%	226	NR	147,910	217,648	Public, private network systems
6	5	Northern Telecom (Canada)	7,861	8,148	-3.1%	(1,070)	NR	60,293	135,140	Public, private network systems
7	6	Ericsson (Sweden)	7,703	8,088	+34%	399	+150%	69,597	116,215	Public, mobile network system
8	8	IBM (U.S.)	5,300	62,716	-2.8%	8,797	NR	256,207	244,786	Computer networking products & systems
9	9	Fujitsu (Japan)	4,388	28,231	-9.3%	236	NR	163,990	1172,153	Publiic, private network systems
10	10	Bosch Group (Germany)	2,655	19,655	-5.6%	433	-42%	156,615	125,501	Public, private network systems
11	17	Nokia (Finland)	2,161	4,418	+30%	1,146	NR	25,800	1160,785	Mobile, public network system
12	18	Matsushita Electric (Japan)	2,046	59,565	-6.1%	1,153	-21%	254,059	234,452	Private network equipment
13	11	GEC (U.K.)[2]	1,917	14,571	+3.1%	1,301	+0.1%	86,121	169,191	Public, private network systems
14	13	Philips (Netherlands)	1,831	31,672	+0.5%	822	NR	238,500	132,798	Mobile, public network systems
15	26	Samsung Electronics (South Korea)	1,788	10,159	+34%	262	+122%	44,733	227,119	Public, private network systems

Notes: Figures are for 1993 fiscal year. Figures for Japanese and U.K. companies are for year ended 31 March 1994. All figures converted to U.S. dollars at 1993 average exchange rates.
[1]Communications equipment revenue estimates by Sirius.
[2]GPT revenue included in GEC figures, not Siemens.

SOURCE: CommunicationsWeek International; Sirius, Montpellier, France.

projected to grow much faster than the U.S. market.[74] Moreover, the export of services to Europe is expected to foster the sale of U.S. telecommunications equipment and strengthen the competitiveness of the U.S. services industries—such as airlines, hotels, and banks.[75]

Third World markets are also very promising, because penetration levels are so low, and many of these countries are now opening their markets to foreign competition. For example, with a penetration rate of 0.98, and a population totaling more than one billion, China provides a major opportunity for U.S. equipment suppliers. In the case of Latin America, the potential for American companies is equally great. In Mexico alone, the market for wireline equipment now exceeds $2 billion annually.[76] As developing countries press to modernize their networks, the market for advanced technologies will also experience considerable growth. In 1992, more than $4.6 billion was spent on digital switching in the developing countries, and it is estimated that the market will total more than $7 billion by the turn of the century.[77]

The Convergence of Prices and Product Offerings

The development of a global market depends not only on a greater exchange of communication and information-related products and services across national boundaries. For a unified market to exist, there must also be widespread access to market information and a convergence of prices and product offerings. The expansion of trade—such as we are witnessing today in telecommunications—will help to drive this convergence. For, as markets become more global, so will competition and the availability of market-related information. At the same time, however, to the extent that price differentials are artificially maintained, the cost and complexity of doing business will be increased—and global trade will be inhibited, and global trading patterns distorted, as a result.

Telecommunications pricing is reflected in public tariffs, which lay out all of the telecommunication options, together with price and conditions of service.[78] These tariffs have always been subject to political as well as economic factors, because governments have traditionally been the providers of services, for the most part. Thus, rates have been set not only to reflect costs but also to promote universal services through cross subsidization or—as is happening in many developing countries today—to generate revenues for unrelated government operations. Not surprisingly, under these circumstances, prices and services have varied significantly from country to country.[79]

Significant price distortions were tenable in a national regulatory environment, in which most of the trade that took place was internal to the firm. Some services could be used to subsidize others, so long as costs were covered overall. When transactions occurred across national boundaries, as in the case of international telephone calls, pricing arrangements were negotiated through the appropriate state authorities.

In today's global economy, such pricing strategies will have much greater consequences, serving to inhibit and distort international trade. Without standardized services and a relatively common scheme of pricing, businesses will find it extremely difficult to manage global networks.

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[74] OTA, *Telecommunication Services in European Markets*, op. cit., footnote 65.

[75] Ibid.

[76] Ibid.

[77] Robin Bromby, "Digital Switching Markets in Developing Countries Report," *Telecommunications (International Edition)*, Vol-27, October 1993, pp. 16–18.

[78] A tariff describes the services available, the conditions under which they will be provided, the cost structure, and the price of service. For a discussion of tariffing and the general factors on which it is based, see Phyllis Bernt and Martin Weiss, *International Telecommunications* (Carmel, IN: Sams Publishing, 1993), pp. 37–53.

[79] Ibid. See also Robin Mansell, "Tariffs: Who Should Pay for the Telecommunication Network?" *Telecommunications*, July 1993, pp. 41–45.

Special efforts will be required to identify and negotiate the appropriate services and terms. Where there are major price and service disparities, traffic will likely be routed in round about ways through countries such as the United Kingdom or Singapore.[80] In other cases, however, the search costs entailed in setting up a network may simply be so high as to outweigh any benefits from their use.[81]

The impact pricing disparities can have on trade is particularly apparent when reconciling international accounts. International calls entail the use of facilities in two countries, so revenues and costs must be shared between them. To settle accounts, providers in the countries where a call originates pays facility owners in the countries where it is completed a sum based on a bilaterally negotiated "accounting rate" (the agreed upon cost of the call) and "settlement rate" (the agreed upon percentage split of the revenues, which customarily is 50 percent).

If there is a large gap in the prices charged in each country, problems are likely to arise, as is the case in the United States today. When possible, users initiate calls in the United States because the rates, which are subject to competitive pressures, are lowest there. This is not necessarily beneficial, however. Because American providers initiate more calls than they receive, they must pay out an excess of funds, which take the form of a trade deficit.[82] Moreover, because international accounting rates do not match true costs, American service providers may not cover their total costs. In fact, depending on the accounting and settlement rates, they may actually subsidize a foreign vendor's service.[83]

Nonetheless, the pressures for liberalization continue to swell. These include, for example, the incorporation of telecommunication services within the framework of the General Agreement on Tariffs and Trade (GATT) and the North American Free Trade Agreement (NAFTA); competition from multinational providers and advances in networking technology that permit bypass of the public switched network; the European Community Open Network Directive; as well as the persistent demand of large, multinational business users (see box 4-5).[84] Given these forces for change, it is not surprising that, even in the case of such traditional state-oriented stalwarts as Ireland, Spain, Portugal, and Italy, steps are being taken to move towards more international cost-based tariffs.[85]

Privatization and the Shift of Networking Activities to the Marketplace

Globalization is also being furthered through the movement to privatize the provisioning of communication products and services.[86] This trend towards privatization reflects the growing economic value of communication and information in society. Although communication has always served a critical function, its economic value looms even larger today in a global knowledge-based society. To capitalize on this development, PTTs throughout the world are selling off either all or part of their telecommunications facilities to global private sector providers and investors, with expertise and capital to spare. According to

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[80] Singapore is now connected to three international cable systems and plans to be a partner in six by 1996. See "Singapore Telcom Announces SEA-ME-WE Inauguration," *Telecommunication Highlights International*, Nov. 2, 1994, p. 3.

[81] Bernt and Weiss, op. cit., footnote 80.

[82] Mansell, op. cit., footnote 81, p. 41.

[83] Bernt and Weiss, op. cit., footnote 80, pp. 83–97.

[84] Ibid. See also "Study Says EC Firms Favor Opening Telecommunications," *Telecom Highlight International*, Sept. 29, 1993, vol. 15, No. 39, p. 7.

[85] "The Countries of Europe React to Spur of Global Competition," *INTUG News*, October 1993, p. 4.

[86] See, for a general discussion, G. John Ikenberry, "The International Spread of Privatization Policies: Inducement, Learning and 'Policy Bandwagoning,'" in Ezra N. Suleiman and John Waterbury, *The Political Economy of Public Sector Reform and Privatization* (Boulder, CO: Westview Press, 1990), pp. 99–106. For a discussion of privatization in telecom, see Bjorn Wellenius and Peter A. Stern (eds.), *Implementing Reforms in the Telecommunications Sector: Lessons From Experience* (Washington, DC: World Bank, 1994).

BOX 4-5: Telecommunications and Trade

The Uruguay Round of the General Agreement on Tariffs and Trade (GATT) was the first in the GATT's 50 year history to cover trade and investment in the service sector. The General Agreement on Trade in Services (GATS) contains three interrelated sections. The first establishes the rights of users and service providers in foreign countries in such areas as most-favored-nation treatment (nondiscrimination among foreign service providers), national treatment (equal treatment for domestic and foreign service providers), transparency (publicly available information), market access, and the free flow of transfers and payments.[1] The second section provides a timetable by which each country commits to applying the specified rules. The final section sets forth guidelines for continued negotiations in telecommunications, financial services, air transport, and labor mobility.

The telecommunications component of the GATS—the telecommunications annex—covers only "enhanced" or "value-added" services (i.e., services in which signals require some form of manipulation). Examples of such services include electronic data interchange, electronic mail, credit-card verification and database access. The annex ensures that national telecommunications regulations be transparent and that foreign firms and individuals have access to basic telecommunication services as well as intracorporate communications across national borders. The annex also includes a commitment by developing nations to raise the percentage of telecommunications equipment on which tariffs would not be raised above a certain bound rate.[2]

The United States sought unsuccessfully to include the provision of basic long-distance and local telecommunications services within the scope of the telecommunications annex. The practice of subsidizing local telephone service with higher rates on long-distance service was also left unaddressed by the annex. However, the signatories did agree in April 1994 to initiate a Negotiating Group on Basic Telecommunications to pursue further market liberalization through voluntary negotiations to be completed by April 1996. Negotiators from 24 nations and a representative from the European Union met four times in 1994 to discuss differences among national regulatory regimes and strategies for greater market liberalization. The group has since grown to include India, which privatized its basic and cellular telephone services at the end of 1994, and an additional 31 nations that are participating as observers.[3] The group will continue to meet every other month during 1995 to explore possible bilateral agreements, and a full plenary session was scheduled for July 10, 1995.[4]

The provisions for telecommunications trade liberalization in the North American Free Trade Agreement (NAFTA) mirror very closely those achieved in the Uruguay Round of the GATT. The greatest market-opening achieved by NAFTA is the Mexican market for enhanced services previously off limits to companies with majority foreign ownership. The Mexican long distance market will become open to private investment in 1997 creating further opportunities for U.S. companies.

(continued)

BOX 4-5: Telecommunications and Trade (Cont'd.)

The first World Telecommunications Development Conference (in Buenos Aires, Argentina, in March 1994) and the vision of a "Global Information Infrastructure" (GII) articulated by Vice President Al Gore, have further energized the drive toward telecom deregulation and market liberalization. Vice President Gore outlined the five principles guiding the U.S. plan for the National Information Infrastructure (NII)—private investment, competition, flexible regulatory framework, open access and universal service—and suggested that they be incorporated into the Buenos Aires Action Plan, the blueprint for the next four years of telecommunications development. The same five principles plus a sixth regarding diversity of content including cultural and linguistic diversity were endorsed by representatives of the 34 democracies in the Western Hemisphere at the recently completed Summit of the Americas. The GII was also a topic for discussion at the Asia Pacific Economic Cooperation forum in November 1994, and the Republic of Korea is considering a Ministerial Meeting on telecommunications for 1995. Finally, members of the Group of 7 Industrialized Nations held a Ministerial Conference on the Global Information Society in February of 1995 to discuss further market opening.[5]

[1] See M. Angeles Villarreal, "*Telecommunications Services: Provisions in the Uruguay Round and in NAFTA*," Congressional Research Service, Aug. 11, 1994.

[2] The percentage of telecommunications equipment covered by bound tariffs increased from 35 to 95 percent. U.S. Department of Commerce.

[3] Nations participating as observers include: Brazil, Indonesia, Singapore, Venezuela and South Africa. "WTO Telecom Talks Pick Up Momentum," *Telcom Highlights International*, Mar. 15, 1995, p. 4.

[4] Ibid.

[5] Raphael Cung and Susan Gates, "Secretary Brown Leads Mission to Asia, Represents U.S. at APEC Meetings," *Business America*, November, 1994, pp. 6–9.

SOURCE: Office of Technology Assessment, 1995.

one estimate, 45 percent of the world's access lines are privately managed today.[87]

In Europe, privatization aims to enhance the competitiveness of national telecommunication providers.[88] One by one, European governments are recognizing that state owned PTTs will be greatly disadvantaged in an intensely competitive and rapidly expanding global market. In fact, they may be unable to join the fray, without the freedom and flexibility required to enter new markets and establish new alliances.[89] Most striking in this regard is, perhaps, the recent conversion of the French and German governments. Long a proponent of centralized state control, the French government decided to transform France Telecom into a joint stock company with the state retaining monopoly control. Similarly, the German parliament has agreed to a plan for privatizing Deutsche Telekom.[90]

Similar motives are driving privatization in Asia—at least among the most economically advanced countries—with Japan, Australia and New Zealand leading the way. Change is also taking place in the less well-off regions of Southeast Asia. Singapore Telecom, for example, has established a joint public-private telecom venture, which many view as a first step toward total

[87] See, "What Are the Implications for Your Business in the Global Telecom Revolution?" *Management Accounting*, June 1992, p. 46; See also Stephen McClelland, "The International Dimensions: PTTs," op. cit., footnote 22, June 1992, p. 31.

[88] In its green paper on telecommunications, the Commission of the European Community called for a competitive community-wide telecommunications market by 1998.

[89] As described by McClelland, "Internationalization has become the order of the day, with a first strike at someone else's territory as the preferred method of defense." op. cit., footnote 87, p. 31.

[90] "The Countries of Europe React to Spur of Global Competition," *INTUG News*, October 1993, p. 305; and "Deutsche Telkom Plan Approved," *Telecom Highlights International*, July 7, 1993, vol. 15, p. 27.

privatization.[91] Indonesia already has such a corporate arrangement. In Malaysia, the PTT is privatized, with its stock now floated in the marketplace.[92]

Fully aware of the growing importance of communication for economic growth, many developing countries hope privatization will facilitate access to the foreign capital and expertise needed to develop their national communication infrastructures. In Latin America, Mexico serves as a model of industry restructuring, having privatized its state PTT, TELEMEX, with record speed.[93] The government plans to sell its remaining stake in TELMEX for approximately $600 million. Foreign capital has also been invested in Telefonos de Venezuela and Telefonica de Argentina.

Similar modernization strategies are being pursued in other parts of the world. India, for example, is developing a plan to open up its telecommunication sector to private investment, as are countries in Eastern Europe.[94] Even China, which has long opposed foreign investment, is now considering foreign bids to support its goal of providing 40 million new lines by the year 2000. Such privatization strategies have also gotten a boost from the World Bank, which has made financial aid for infrastructure development contingent on competitive reforms.[95]

Investors to fund such national privatization efforts have not been hard to find. To the contrary, global telecommunication investors view emerging economies as a bargain, if not a potential gold mine.[96] Purchasing prices and interest rates are low, and the cost of the technology is declining. At the same time, dividends are rising and the annual per-share earning growth rates of telecom range between 15 to 20 percent.[97] Investors also benefit from preferred access to a new and rapidly expanding market sector.[98] Regulatory restrictions in the United States provide the Bell Operating Companies with an additional incentive for foreign investment, and indeed they have been among the most active in this regard.[99]

Privatization efforts are not limited to nation states. There is a move underway to privatize Inmarsat, an international treaty organization established in 1979 to provide communication services to ships—especially those from poor countries. As Inmarsat has expanded into more and more lucrative activities, the pressure has grown to transform it into a private sector organization. Thus, a proposal has been made to allow its members to trade their holdings. The stakes are considerable. Providing services such as portable satellite communication for emergency services, the media, and the airlines, Inmarsat has grown at an annual rate of 20 percent over the

[91] "Singapore Starts Telecom Sell-off," *Telecom Highlights International*, vol. 15, No. 34, Aug. 25, 1993, p. 5.

[92] "World Bank Paper Urges Telecom Liberalization," *Telecom Highlights International*, vol. 16, No. 8, Feb. 23, 1994; and "More Notes on the S.E. Asia Market Potential," *Telecom Highlights International*, Mar. 16, 1994, vol. 16, No. 11, p. 3. Taking advantage of Western capital and expertise, Malaysia aims to increase phone subscribers from 2.3 million today to 7.8 million by the year 2000.

[93] Restructuring usually takes place by selling companies privately. In some cases, however, they are first sold to a consortium, the stock of which is later sold publicly. Sometimes the U.S. portion of the consortium and the stock are later sold to institutional investors. See Margaret Price and Marlene Givant Star, "Privatization Brings Global Opportunities," *Pensions and Investments*, July 26, 1993, p. 3. For a comparison of the approaches being followed in Latin America, see Randa Zadra, "The Telecommunication Revolution in Latin America," *Telecommunications*, July 1993, pp. 33–36.

[94] For example, Matav, the state telephone company of Hungary, recently sold 30 percent of its holding to an American-German consortium made up of Ameritec Corporation and Deutsche Bundespost Telekom, for $850 million. This deal is the largest to date in Eastern Europe. The consortium will have exclusive rights to provide local service in 29 out of 56 regions for the next eight years. See "Western Ventures Helping Eastern Europe," *Telecom Highlights International*, vol. 16, No. 2, Jan. 12, 1994, p. 1.

[95] "World Bank Sets Telecom Aid Rules," *Telecom Highlights International*, vol. 16, No. 11, Mar. 16, 1994, p. 4.

[96] Ibid.

[97] Patricia Kranz and William Glasgall, "Bells Are Ringing All Over the World," *Business Week*, December 27, 1993, pp. 96–97.

[98] Margaret Price and Marlene Givan Star, op. cit., footnote 95, p. 3.

[99] OTA, *Telecommunication Services*, op. cit., footnote 65.

past decade and now has accumulated assets totaling $400 million.[100] Not surprisingly, its competitors—including among them state-owned, nonprofit organizations and private sector companies—want to limit its activities. They argue that Inmarsat has an unfair advantage, given its intergovernmental treaty status.[101]

Worldwide Provisioning of Services

Global providers of telecommunication and information-based products and services are emerging to meet worldwide demand. Less hampered by domestic constraints, a rash of telecommunication providers has appeared on the global scene.[102] To stake out new markets, share the high risks and costs of technology development, and better provision their services on a worldwide basis, these carriers are aggressively setting up global partnerships, consortia, and joint ventures.[103]

However, despite the rapid growth in worldwide demand and the present high rates of investment, many suspect that—over the long term—there will not be sufficient money or markets to go around.[104] Estimates are, for example, that when the inevitable shake out occurs, only five to seven global conglomerates can survive.[105] So the time is short, and the competition for partners fierce. As aptly described by one participant observer, "We're at the stage of [the game of] Monopoly where you buy everything that is available. The next stage is to form consortia with other players as the initial opportunities become limited. The last phase, yet to come, could be some form of cash-flow race for the finishing line."[106]

The top contenders are focusing on the lucrative "outsourcing" market. They are striving to be the major provider of seamless global communication to the world's largest 500 multinationals. This market is estimated at $10 billion, and rapidly growing.[107]

AT&T, for example, has established WorldPartners, a one-stop-shopping consortium and joint venture, in conjunction with Japan's largest international provider, KDD, and Singapore Telecom. The WorldPartners Association also includes members of Unisource, the network services company formed by PTT Telecom Netherlands, Spain's Telefonica, Sweden's Telia, and Swiss Telecom PTT. Unisource has most recently been exploring an equity partnership with AT&T to cement their global services agreement.[108]

Soon after the announcement of WorldPartners, British Telecommunications (BT) and MCI struck a $4.3 billion deal, which has received the approval of both the U.S. Justice Department and the European Commission. The partnership calls for both a new outsourcing venture to provide global voice and data services, and for BT's purchase of a 20 percent stake in MCI. BT will own 75 percent of the joint venture, NewCo., with MCI holding the remaining share. The Norwegian, Dutch, and Finish phone companies have also joined the BT-MCI alliance.[109]

Alarmed at the prospect of competition from global outsourcers, France Telecom and Deutsche Telekom have also established a joint venture called Eunetcom. This group has had some difficulty getting off the ground, and especially in finding partners.[110] Its first choice, MCI,

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[100] "Notes on the Possible Privatization of Inmarsat," *Telecom Highlights International*, Dec. 8, 1993, vol. 15, No. 49, p. 15.
[101] Ibid.
[102] Peter Heywood, "Fresh Air for Cross Border Networking," *Data Communications International*, April 1993, p. 93.
[103] Klaus Grewlich, "Agenda for the 1990s," in Meheroo Jussawalla (ed.), op. cit., footnote 62, pp. 233–234.
[104] Paul Strauss, "The Struggle for Global Networks," *Datamation*, Sept. 15, 1993, vol. 39, No. 8, p. 26.
[105] Stephen McClelland, "Global Chess," *Telecommunications International*, vol. 27, No. 7, July 1993.
[106] Richard House, "A Global Mating Game," *Institutional Investor*, September 1993, pp. 65.
[107] "Global Telephone Networks Expand," *Corporate Growth Report*, June 14, 1993, p. 6685.
[108] Peter Olsthoorn and Jennifer L. Schenker, *CommunicationsWeek International*, Sept. 12, 1994, p. 2.
[109] Richard L. Hudson and Charles Goldsmith, "Phone-Industry Alliances in Europe Face Tough Scrutiny, Regulator Warns," *The Wall Street Journal*, Sept. 20, 1994, p. A7C.
[110] Jonathan Levine, "A Counter Coup in Telecom," *Business Week*, Nov. 15, 1993, pp. 51–52.

defected to establish a joint venture with British Telecom, and it is awaiting approval of an alliance with U.S. long-distance carrier Sprint.[111]

NETWORKING PROSPECTS IN THE THIRD WORLD

The forces for globalization are, today, converging in the Third World. How this trend will affect the prospects for networking in developing countries is difficult to predict. The outcome will depend not only on the rate of technology diffusion, the quality and sophistication of the network, and network architecture. Equally important will be the financial and human resources available in Third World countries, the functioning of their markets, the quality of their legal and regulatory frameworks, as well as their levels of government competence.

Third World Networks: An Overview

There is a tremendous gap between the developed countries and the Third World in terms of the number, variety, and quality of communication and information networking technologies. In the average U.S. home, for example, there is likely to be at least one, if not two or more, telephones, televisions, as well as subscriptions to cable services. And, an ever growing number of American families now have computers that can be linked up to access global information services. In stark contrast, more than half of the population of the developing world has never made a simple phone call. In some regions, such as Rwanda and Niger, there is only one main telephone line per 1,000 persons.[112]

Even more alarming, the gap between the telecommunications "haves" and "have nots" shows little signs of receding. In the 10 years since the Maitland Commission issued its report *The Missing Link*—which first noted the telecommunications gap and called on developed countries to take steps to reduce it—very little progress has been made.[113] There are today 50 countries, which together comprise more than half of the world's population, that still have under one main telephone line for every 100 persons. Given their present rates of technology deployment, many of these countries will fail to reach this level of teledensity by the year 2000.[114]

One factor accounting for this disparity in network diffusion has been insufficient investment. Investment is especially important in highly capital intensive sectors such as telecommunications. Although developing countries have increased the amount that they invest annually—from $3 billion in the 1970s to $12 billion in the late 1980s—they have been unable to keep up with the unmet demand for telephone services. (in 1988 U.S. dollars.)[115] To achieve such a goal, estimates are that Third World countries must invest approximately $25 billion on an annual basis throughout the 1990s.[116] The pay-off for such investments will likely be high in terms of both financial returns and network diffusion. As is depicted in figure 4-1, countries that reinvested a higher proportion of their telecommunications revenues (with the exception of SubSahara Africa) experienced the most rapid rates of network growth. Financial returns are similarly high. According to the World Bank, the economic return on World Bank supported telecommunications projects averages 19 percent (see table 4-4).

Inadequate investment in network infrastructure can be explained in part by the paucity of financial and technical resources to be found in

[111] Hudson and Goldsmith, op. cit., footnote 111.

[112] All told there are 23 countries that have five or fewer lines per 1000 persons. See *World Development Report 94*, op. cit., footnote 4. p, 224.

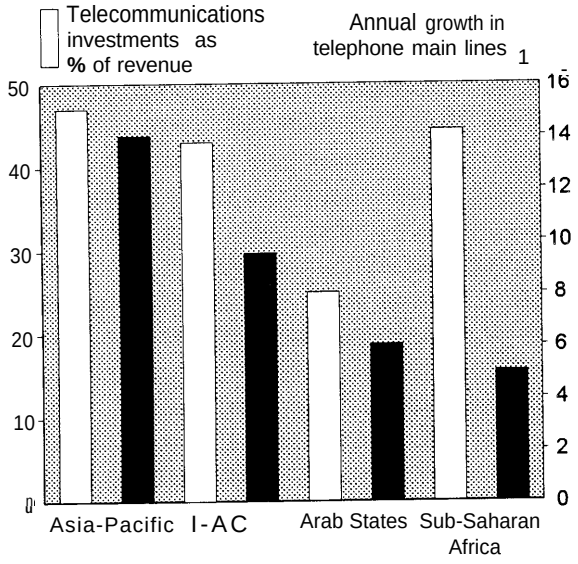
[113] ITU, *World Telecommunications Development Report:World Telecommunication Indicators* (Geneva, Switzerland, 1994), p. 73.

[114] Ibid.

[115] Robert J. Saunders, Jeremy J. Warford, and Bjjorn Wellenius, *Telecommunications and Economic Development* (Baltimore, MD; Johns Hopkins University Press, 1994), p.74.

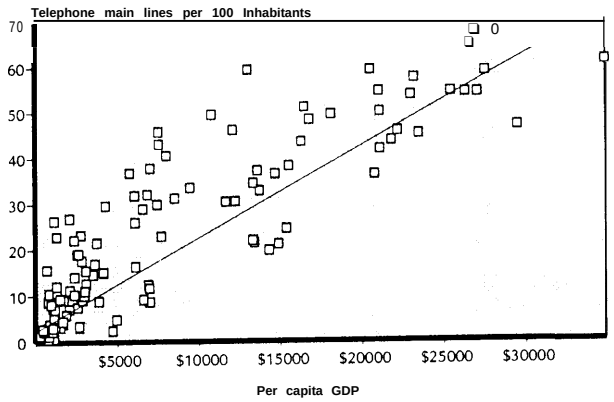
[116] ITU, *World Telecommunication Development Report*, op. cit., footnote 115.

FIGURE 4-1: Telecommunications Investment and Growth in Main Lines



SOURCE: ITU, World Telecommunications Development Report, 1994.

FIGURE 4-2: National Wealth and Telephone Density



SOURCE: ITU, UN, World Bank, OECD

TABLE 4-4: Average Percentage Rates of Return on World Bank-Supported Projects, 1974–1992

sector	1974-82	1983-92
Irrigation and drainage	17	13
Telecommunications	20	19
Transport	18	21
Airports	17	13
Highways	20	29
Ports	19	20
Railways	16	12
Power	12	11
Urban development	..	23
Water and sanitation	7	9
Water supply[a]	12	8
Infrastructure projects	18	16
All Bank operations	17	15

.. Not available.
[a]Rates are financial, not economic, rates of return.
SOURCE: World Bank data.

the Third World. The relationships between teledensity and financial resources (as measured by GDP) is depicted in figure 4-2.

Constrained by the need to restructure their economies and pay off their foreign debts, many Third World countries have lacked the funds to invest in infrastructure development. Foreign exchange for advanced telecommunication equipment has been especially in short supply.[117] While domestic currency can be used to finance the technology for the local portion of a telecommunication network, more sophisticated technology —which can only be purchased in the global market—will be required for the major backbone portions of Third World networks. The foreign exchange problem is particularly acute for countries-such as many of those in Africa—that have no indigenous telecommunications sec-

[117] As noted by the ITU "The terms of trade for developing countries deteriorated during the 1980s so that many countries are now spending an increasing amount of their foreign exchange earnings on debt servicing. Total external debt as a percentage of exports rose from 125 percent in 1980 to 177 percent in 1991 for low- and middle-income countries. Some developing countries are also faced with ongoing currency devaluations which make imports more expensive." Ibid., p. 88.

tor and/or that have major outstanding foreign debts.[118]

In some countries, government-owned PTTs have consciously made telecommunication investment a second order priority. Instead of reinvesting their operational surplus, telephone administrations siphon it off for other government purposes. In Syria, for example, the government imposed an 80 percent tax on the state owned telephone company from 1985 to 1991.[119] Such practices may diminish in the future, given greater appreciation of the economic benefits associated with network deployment. Already, by 1990, 40 Third World countries had either begun or were preparing to revamp their telecommunication administrations so as to achieve greater network modernization.[120]

In the poorest areas, resources for network deployment are also limited by the lack of a sizable middle class with disposable income to buy the services and equipment required to effectively drive sales and investment. Even when demand is high—as is often the case in urban areas—it may be dampened by artificially high prices, which are based on tariff structures designed not only to cover costs but also to generate general revenues.[121]

Uneven network deployment occurs not only between countries but also within the developing countries themselves. As depicted in table 4-5, when Third World countries have had resources for investment, they generally use them to build up telephone infrastructure in large cities instead of rural areas. Of course, this focus makes sense, because cities are home to most businesses, middle class consumers, and politically active citizens alike.[122]

The prospects for the poorest countries and poorest regions within countries thus seem bleak, even given major technology advances. Consider, for instance, the case of low earth orbiting satellites (LEOs), which have been touted for their promise for developing countries. Although LEOs can greatly extend the geographic scope of communications, they will not necessarily improve access. Given the high costs of developing these systems, services will likely be prohibitively expensive for many, at least in the near term.[123] For example, even when mass produced, Motorola's Iridium phone will cost an estimated $1,500. At this price, a person living in the Central African Republic, earning on average $376 per year, would have to work four years to buy a telephone. With service estimated to cost about $3.00 per minute, he or she would have to work 17 hours to pay for a one-minute phone call.[124]

A lack of education and technical expertise will also make it difficult for developing countries to take advantage of many new technologies. For example, although the Internet provides developing countries with an inexpensive way of gaining access to networking services such as e-mail and remote file transfer, its usage requires a level of technical understanding and comfort not likely to be found in poorer areas. Not surprisingly, therefore, Internet growth has been the strongest in countries such as India and Malaysia where a "computer culture" already exists.[125] In contrast, growth has been slowest in the Middle East, where communication is restricted and information is generally thought of as a source of

[118] See chap. 2, for a general discussion of the debt problem.

[119] ITU, op. cit., footnote 115, p. 119; see also Norm Wingrove, "Telecommunications Spur Technology Advance in Vietnam and Other 'Little Dragons,'" *Research Technology Management*, January/February 1994, p. 2.

[120] Saunders, Warford, and Bjorn Wellenius, op.cit., footnote 115. p. 19.

[121] As described by the ITU, "Telephone subscription charges as a percentage of average per capita income are over 5 in many developing countries; in the low-income countries they are often over 10. In contrast, in most developed countries, subscription charges amount to less than 1 percent of per capita income. op. cit., footnote 115, p. 77.

[122] Ibid.

[123] See Joseph Pelton, "Will Smart Sat Markets Be Large?" *Satellite Communications*, February 1993, pp. 39–42. See also, Richard L. Hudson, "Inmarsat Begins Fund-Raising Drive for $2.6 Billion Satellite Phone System," *The Wall Street Journal*, Sept. 12, 1994, p. B8.

[124] OTA, *The 1992 World Administrative Conference*, op. cit., footnote 39, p. 124.

TABLE 4-5: Number of Main Telephone Lines Per 100 Persons in Selected Countries as of January 1, 1988

Region and country	National	Main cities[a]	Other areas
Industrial countries			
Austria	38.38	54.20	31.32
Canada	44.49	59.20	43.45
Denmark	55.13	59.58	52.36
France	44.68	47.98	29.27
Germany[b]	39.27	50.20	35.98
Italy	33.28	41.48	30.65
Japan	40.81	56.13	37.48
Norway	46.41	55.81	41.89
Spain	26.18	31.84	21.02
Switzerland	52.87	65.54	46.73
Developing Countries			
Africa			
Algeria	2.70	7.13	1.58
Ethiopia	.24	3.39	.04
Kenya	.66	4.95	.19
Malawi	.28	2.20	.07
Morocco	1.14	3.17	.42
Sudan	.24	1.32	.04
Togo	.28	1.27	.00
Tunisia	3.01	7.00	.79
Zambia	.73	1.36	.17
Zimbabwe	1.45	6.39	.41
Asia			
Iran	3.15	6.31	1.10
Malaysia	7.21	22.65	5.17
Pakistan	.61	2.69	.19
Papua New Guinea	.91	5.91	.22
Sri Lanka	.54	1.12	.29
Thailand	1.67	6.94	.45
Turkey	7.01	7.46	6.56
Latin America			
Brazil	5.59	10.17	4.14
Colombia	7.20	13.26	1.83
Costa Rica	8.62	15.28	2.57
Ecuador	4.41	8.27	1.91
Peru	2.30	4.90	.52
Uruguay	10.61	16.05	5.24
Venezuela	9.19	16.20	5.08

[a] Defined by the national administration; population thresholds, and consequently the number of cities included, vary widely among countries

[b] Estimated from combined Federal Republic of Germany (January 1987) and German Democratic Republic (January 1988) data.

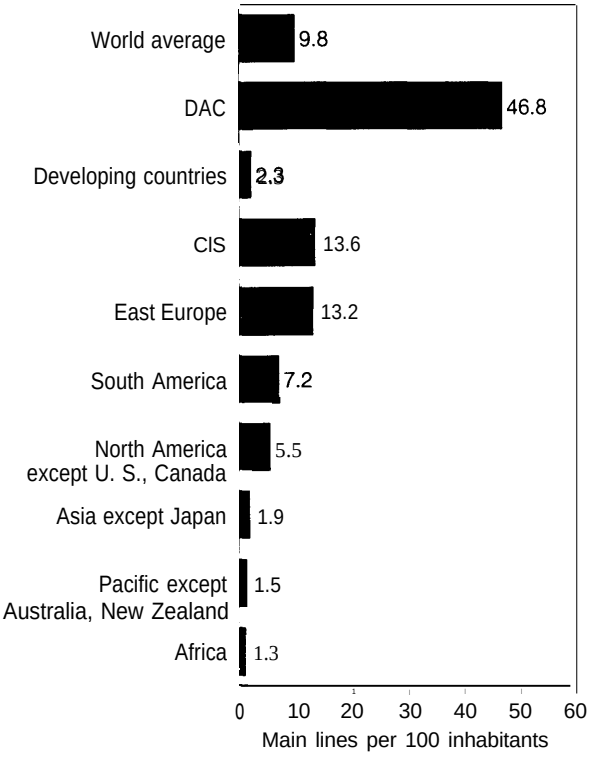
SOURCE: World Bank

power. In 1994, Muslim countries accounted for a mere 42 of the 15,000 nets on the global Internet; and as many as 29 of these nodes were located in Tunisia. [126]

As in the case of all networking technologies, the acceleration of network deployment in the Third World requires a critical mass of users. Based on experiences in other countries, this "take-off" stage will occur when teledensity approximates 10 to 20 percent. As can be seen in figure 4-3, many regions in the world have far to go before they reach this point. Thus, if countries are to have access to even the most basic form of communication services, a greater priority must be given to infrastructure investment. According to the ITU, developing countries must invest at least 3.5 percent of their gross domestic investment.

Even after a critical mass has been achieved, significant national disparities in technology deployment will likely persist due to the rapid pace of technology change, the money required for investment, as well as major national discrepancies standards of living and the ability of countries to generate both the capital and the human resources required to develop and deploy advanced communication/information systems. Even as some countries race to keep up, others are deploying yet more advanced technology. [127] For example, it is estimated that it will cost $120 billion between now and early 2005 just to upgrade the Central and Eastern European communication networks. During the same period, the European Community will spend approximately $18.6 billion per year to develop a broadband telecommunication infrastructure. 128

FIGURE 4-3: Teledensity by Region



KEY: DAC=Development America Assistance Committee of the OECD; CIS=Commonwealth of Independent States

SOURCE: NTT America.

■ Alternative Sources of Funding

Third World countries must provide the bulk of investment required to develop their own communication and information infrastructures. However, in many cases, access to additional funding may be critical to success. Given the growing number of lucrative businesses opportunities to be found in the developing world, foreign investment can be expected to provide most of this funding. Such investment has already reached an all time high, last year tripling the amount received from governments as foreign assistance. [129]

126 Ibid.

127 As noted by the ITU, "The majority of telecommunications capital spending is in developed countries. Of the $125 billion spent on telecommunications in 1992, 80 percent was in high-income economies. Of that figure, over 60 percent was in just three countries: Germany, Japan, and the United States, ITU, op. cit., footnote 115, p. 87.

128 Jennifer L Schenker, "No Turning Back," *CommunicationsWeek International*, Sept. 26, 1994, p. 12–15.

129 According to the World Bank, private investment increased 50 percent in 1993, and another 9 percent the following year to total $179.9 billion in 1994. In contrast, governmental aid remained unchanged during this period, totaling $54.5 billion in 1994. See "Private Investment to Poor Nations Hits a Record High at World Bank," The *Washington Post*, Jan. 23, 1995, p. A14.

Despite the growth of private financial flows to developing countries, foreign assistance can still play a critical role. Circumventing the poorest countries, most private funding has been channeled to those Third World countries that are already experiencing rapid growth. Foreign assistance, if targeted carefully, can be used to leverage this private investment and to fill in the funding gaps.[130]

The Growth in, and Distribution of, Private Foreign Investments

Private capital flows to the Third World totaled $165.6 in 1992, an increase of $32 billion—or 23 percent—from the previous year.[131] This strong growth in private financial flows is being driven by high competitive rates of return, growing confidence in Third World political and economic stability, as well as by the developing countries' concerted efforts to reform their economies and open them up to trade and foreign investment. Two types of investment merit special attention—equity and foreign direct investment. A fair portion of these funds will find their way into the telecommunication and information technology and services sectors.

Equity investments

Equity investments can provide an increasingly important source of funding for telecommunication infrastructure, given many developing countries' efforts to upgrade, and revitalize, their stock exchanges. Third World stock markets already constitute approximately 7 percent of world market capitalization and 10 percent of the total value of the worldwide stock market.[132] As developing countries take further steps to privatize portions of their national telephone administrations, their telecom stock issues are becoming more and more prevalent.[133] These telecom stocks are generally rated very highly, especially in the fastest growing regions such as Asia's Pacific Rim.[134]

Equity investments, however, are far from being equally distributed throughout the developing world. The countries that are the most developed are the ones to be targeted for this kind of investment, with the poorest countries receiving but an insignificant amount (see table 4-6).[135] This distribution pattern reflects the tendency of equity markets to develop after countries have adopted market oriented reforms, and when they can boast of reasonable levels of political stability. Poorer countries have also been more reluctant than those with dynamic economies to encourage this type of investment. Not having a strong indigenous economy of their own, they are more vulnerable to the potential instability of foreign equity investment. These countries are concerned, moreover, lest foreign investors come to dominate key sectors such as telecommunications.[136]

Foreign direct investment (FDI)

The trend towards privatization in the developing countries has also opened the door to greater

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[130] The Revival of Private Flows to Developing Countries," *Financial Market Trends*, Oct. 9, 1993, pp. 21–40.

[131] Ibid.

[132] Peter Cornelium, "The Internationalization of Emerging Stock Markets," *Intereconomics*, May/June 1994, pp. 131–138.

[133] Dean Lewis points out five different ways of privatizing: 1) negotiated sale of 100 percent of the company to a single buyer; 2) sale of a minority stake to a single buyer or group of buyers; 3) public offerings in the domestic market or international markets or both; 4) sale of a minority stake to a single purchaser combined with a public offering; and 5) break up and sale of components. As he notes, "How the enterprise is sold will be determined largely by the government's objectives for the privatization program and by the commercial and policy constraints surrounding the transaction." Dean Lewis, "Options for Selling a Telecommunications Company," in Bjorn Wellenius and Peter A. Stern, *Implementing Reforms in the Telecommunications Sector: Lessons From Experience* (Washington, DC: World Bank, 1994), chap. 28, p. 431.

[134] See "Asian Telecoms Ringing Off the Hook," *Barron's*, Oct. 12, 1993, p. 50; see also Lilia Clemente, *Columbia Journal of World Business*, vol. 29, summer 1994, pp. 92–121.

[135] As described by Clemente, "In 1993... new purchases of foreign equities reached $170 billion. The most common destination was Europe, largely from other European markets, but almost $40 billion flowed into Latin America and Asia's Pacific Rim. U.S. investors accounted for 40 percent of the flows into the Asia/Pacific region and 75 percent into Latin America." Clemente, op. cit., footnote 136, p. 94.

[136] Cornelium, op. cit., footnote 132.

TABLE 4-6: Emerging Stock Markets—Overview

	Market Capitalization (US$ millions)		Value Traded (US$ millions)	Number of Domestic Companies at end	Market Concentration[1]
	1983	1992	1992	1992	
Africa					-
Cote d'Ivoire	248	331	4	24,000	-
Egypt[2]	1,106	2,594	293	656	-
Kenya	-	607	12	57	-
Mauritius	-	377	10	22	-
Morocco	253	1,876	70	62	-
Nigeria	2,970	1,243	23	153	53.6
Tunisia	-	46	2	17	-
Zimbabwe	265	628	20	62	47.7
Asia					
Bangladesh	48	315	11	145	-
China	-	18,314	13,363	53	-
India[3]	7,178	65,119	20,597	6,700	32.2
Indonesia	101	12,038	3,903	155	61.4
Korea	4,387	107,448	116,101	688	22.4
Malaysia	22,798	94,004	21,730	366	14.0
Pakistan	1,126	8,028	980	628	19.1
Philippines	1,389	13,794	3,104	170	30.6
Sri Lanka	-	1,439	114	190	-
Taiwan	7,599	101,124	240,667	256	15.4
Thailand	1,488	58,259	72,060	305	36.3
Europe					
Greece	964	9,489	1,605	129	50.4
Portugal	84	9,213	3,455	191	22.1
Turkey	968	9,931	8,191	145	11.4
Middle East					
Iran	-	1,157	225	118	-
Jordan	2,713	3,365	1,317	103	31.6

(continued)

TABLE 4-6: Emerging Stock Markets—Overview (Cont'd.)

Western Hemisphere					
Argentina	1,386	18,633	15,679	175	72.5
Barbados	-	258	2	15	-
Brazil[4]	15,102	45,261	20,525	565	51.2
Chile	2,599	29,644	2,029	245	57.9
Colombia	857	5,681	554	80	62.9
Costa Rica	118	477	11	93	-
Jamaica	113	3,227	386	48	-
Mexico	3,004	139,061	44,582	195	39.4
Peru	546	2,630	398	287	-
Trinidad & Tobago	1,011	514	22	27	-
Uruguay	9	368	9	26	-
Venezuela	2,792	7,600	2,631	66	80.0
Total	83,222	774,093	594,685	13,217	-

[1]Share of value traded held by ten most active stocks.
[2]Cairo.
[3]Bombay.
[4]Sao Paulo.

SOURCE: International Finance Corporation: Emerging Stock Markets Factbook 1993, Washington, DC, 1993.

(FDI), which—despite the global economic recession—has continued to grow at an amazingly rapid pace.[137] Between 1991 and 1993, FDI to the developing countries increased by 100 percent—from $40 billion to $80 billion—constituting more than one-half of all private flows to the Third World.[138]

FDI in the telecommunications sector has been particularly popular, generally taking the form of either joint ventures or corporatization and sale of a major or controlling equity stake in the telecom provider.[139] These kinds of arrangements offer a number of advantages to developing and developed countries alike.

Developing countries can benefit in a number of ways from the foreign purchase of either all, or a portion of, their telecommunication operations.[140] Such arrangements allow these countries to reduce their foreign debt while upgrading their national infrastructure.[141] At the same time, they can gain greater access to advanced technology, the markets in developed countries, as well as hard currency.[142] FDI are also more secure than other types of foreign investment, being less volatile and subject to interest rate fluctuations.

[137] UNCTAD, *World Investment Report: Transnational Corporations, Employment, and the Workplace* (New York, NY: The United Nations, 1994), p. xix; See also, David D. Hale, "Stock Market: New World" *Columbia Journal of World Business*, vol. 29, summer 1994, pp. 14–28.

[138] Ibid.

[139] Robert R. Bruce, Jeffery P. Cunard, and Lothar A. Kneifel, "Exploring New Ways To Attract Capital for Privatization," in Wellenius and Stern, op. cit., footnote 135, pp. 463–469.

[140] For a discussion of the arguments for and against, see T.H. Chowdary, "Telecommunications Restructuring in Development Countries," *Telecommunications Policy*, September/October. 1982, pp. 591–611.

[141] Often, investors are obligated to expend a considerable amount of money to extend and upgrade service in exchange for control over the enterprise and certain guaranteed exclusive rights. See Aileen A. Pisciotta, "Telecommunications Reforms: Options, Models, and Global Challenges," *IEEE Communications Magazine*, November 1994, p. 29.

[142] Clive Crook, "Third World Finance: New Ways to Grow," *The Economist*, Sept. 25, 1993.

FDI agreements can, moreover, be customized to meet a developing country's specific needs and concerns.[143]

For investors and businesses in developed countries, there are likewise gains to be made. Above all, these partnering arrangements allow foreign vendors to obtain a foothold—and often a major competitive advantage—in some of the most profitable and rapidly growing telecommunications markets. Given the tremendous backlog of demand in developing countries, these investments can be made with minimal risk. By accelerating technology deployment in the Third World, FDI in telecommunications also paves the way for related service industries—such as banking, insurance, and tourism—as well as for multinational corporations, which depend on networking technologies for their survival and growth. In the long run, investments linked to telecom privatization may also enhance the overall economic climate in developing countries in favor of open markets and greater economic reforms.

As in the case of the global equity market, foreign direct investment is somewhat skewed in its distribution. Faced in the 1980s with enormous debt problems, the countries of Latin America were among the first to privatize their telecom operators to attract foreign investment.[144] More recently, many other developing countries are following suit. Today, there are ongoing privatization efforts in the Philippines, Malaysia, Indonesia, and Thailand, to name a few. Countries in sub-Sahara Africa, however, have been noticeably absent from these developments (see box 4-6).

Foreign Assistance for Telecommunications

Aid for telecommunication infrastructure development in the Third World is available from a variety of sources. Because networking is characterized by positive economic externalities, these sources of support will likely be mutually reinforcing. To make the most of this, this aid should be nonduplicative and well coordinated.

Multilateral assistance

Multilateral aid for telecommunications accounted for approximately 3 percent of all global telecommunications investment in 1992.[145] For countries that have very limited foreign exchange and minimal foreign investment, this aid constitutes a primary source of infrastructure investment.[146] In 1992, for example, total capital spending on telecommunications in all of Africa was less than that provided by multilateral lenders.

Telecommunications-related foreign assistance is not a priority for most multinational development banks, accounting for 6 percent of their loans in 1992.[147] This limited funding appears, moreover, to lack a basic, or shared, rationale. As a result, there are few agreed upon measures with which to evaluate its impact, or to justify its future support. Not suprisingly, therefore, the uses of telecom related aid programs has fluctuated up and down, varying considerably by donor, agency and region.

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[143] Flexibility and appropriate timing are critical for success. As pointed out by Smith and Stable, "A large body of international experience with the divestiture of state-owned telecommunications operators indicates the importance of several common procedural and substantive issues. These include the need to state clearly the objectives for divestiture at the outset; allow sufficient time to prepare a carrier for sale, typically two to three years; and secure the legal conditions for sale, which usually involve adopting a legislative reform package and organizing a regulator independent of the incumbent operator. Experience also suggests that the success of a divestiture will be decisively affected by the economic incentive reflected in the price-control rule and the network performance targets, both quantitative (e.g., in the number and location of access lines to be added) and qualitative (e.g., in the number of permissible faults and response to outages)." Peter L. Smith and Gregory C. Staple, "Telecommunications Sector Reform," *IEEE Communications Magazine*, November 1994, p. 51. See also Robert R. Bruce, Jeffrey P. Cunnard, and Lothar A. Kneifel, "Exploring New Ways To Attract Capital for Privatization," in Wellenius and Stern, op. cit., footnote 135, chap. 28, pp. 463–469.

[144] See Stephen J. Dalla Betta, "Telecom Privatization in Latin America," *Telecommunications*, March 1994, pp. 61–64; see also Randy Zadra, "The Telecommunication Revolution in Latin America," *Telecommunications*, July 1993, pp. 33–36.

[145] ITU, op. cit., footnote 115, p. 90.

[146] Ibid.

[147] Ibid.

BOX 4-6: The Africa ONE Project

The African continent is home to 12 percent of the world's population but has only 2 percent of the world's main telephone lines. As of 1993, Africa's measure of teledensity—the number of main telephone lines per 100 people—was 1.6. The comparable teledensity figures for the Americas, Europe and Oceania are 27, 31 and 38 respectively.

A number of African network operators, notably the Pan-African Telecommunications Network (PANAFTEL) and the Regional African Satellite Communications System (RASCOM), are using satellite, radio and other technologies to expand the reach of communications throughout the African continent. But the task of improving telecommunications availability in Africa and connecting the continent more fully to global communications networks remains enormous. Recognizing the magnitude of the challenge and the importance of telecommunications to Africa's social and economic development, the International Telecommunications Union approached AT&T Submarine Systems, Inc. (AT&T SSI) in October 1993 with the challenge of devising a regional telecommunications system that would contribute to the above stated goals.

The result is the Africa ONE Project—a proposed 35,000 kilometer undersea fiber optic ring around the continent with landing points in 41 African countries and in Saudi Arabia and Italy. The cable would utilize the latest optical amplifier technology to provide maximum flexibility and capacity for growth and be capable of transmitting data at the rate of 2.5 billion bits per second. A planned three tier approach would, first, concentrate on linking Africa's populous coastal centers via the undersea cable. Second, inland areas would be interconnected with Africa ONE by satellite or some other means. Finally, Africa ONE would be integrated into existing undersea fiber optic networks and likely spur new transoceanic cables to South America and Australia.

A Regional Authority comprised of representatives from participating National Telecommunications Authorities, RASCOM, international telecommunication carriers and other network investors will govern the operation of Africa ONE. Investment in the expected $1.9 billion network is open to anyone and the Regional Authority that owns and manages the network will operate on a for-profit basis. AT&T SSI, the world leader in the installation of undersea fiber optic cables, hopes that financing for Africa ONE will be in place by the end of 1995 and that the cable will be completed by the end of 1999.

SOURCE: Testimony of William B. Carter, President of AT&T Submarine Systems, Inc. AT&T Corporation before the U.S. House of Representatives Committee on International Relations Subcommittee on Africa and Subcommittee on International Economic Policy and Trade, "Joint Hearing on Trade and Investment in Africa," Mar. 8, 1995. And "AT&T Has Plans for Africa," *Telcom Highlights International*, Apr. 12, 1995, p. 5.

In 1992, the European Investment Bank (EIB) was the largest contributor to such programs, providing close to $3 billion. The bulk of this funding, however, remained in Europe where it was used to help European operators finance overseas operations and acquisitions.[148] Nonetheless, on balance, the EIB provided more telecommunication funding to non-European countries—especially those in Central and Eastern Europe—than most other development agencies (see table 4-7).

The InterAmerican Development Bank ranked at the opposite extreme. Throughout the entire period between 1983 and 1992, the number of telecom-related loans distributed by the IDB totaled 3. In 1992, the IDB provided virtually no telecommunication funding.[149]

[148] Ibid.
[149] Ibid.

TABLE 4-7: Telecommunication Loan Approvals

Lender	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
AsDB	0	72.6	69.0	0	0	135.0	125.4	160.9	0	185.5
AfDB	44.4	28.9	50.9	9.1	0	0	0	73.9	10.5	60.2
IDB	0	25.9	0	0	0	0	0	300.0	0	0
IBRD	32.0	150.0	67.0	50.4	682.3	36.0	161.0	616.7	349.8	430.0
EIB	22.3	0	21.4	22.6	13.9	3.8	54.4	101.8	86.8	219.2
EBRD	—	—	—	—	—	—	—	—	210.9	321.8
Total	98.7	277.4	208.3	82.1	696.2	174.8	340.8	1253.3	658.0	1216.7

Note: Not including telecommunication loans by EIB to Western Europe.
Key: AsDB: African Development Bank; AfDB: Asian Development Bank; IDB: Inter-American Development Bank; IBRD: International Bank for Reconstruction and Development—The World Bank; EIB: European Investment Bank; EBRD: European Bank for Reconstruction and Development.

SOURCE: ITU/DDT Telecommunication Project Database.

Bilateral governmental assistance

Bilateral assistance for telecommunications is similarly diverse in terms of its amount, location, and rationale. The Japanese, for example, provide more telecommunication funding than some multilateral lenders. Most of this funding, which is often bound by trade contingencies, is targeted for countries in Asia. In contrast, the Swedish International Development Authority—in keeping with its long tradition of providing aid for basic needs—has been a major supporter of telecommunications for economic development. Thus, in the decade between 1982 and 1983, Sweden provided approximately $70 million to sub-Sahara Africa, an amount equal to one-third of that provided by the African Development Bank during the same period.[150]

Other sources of telecommunication support

A number of regional and international agencies, which provide social and economic services, have developed networks as part of their operations. The United Nations Development Program, for example, is linked up to nodes in over 100 nations.[151] Similarly, the World Health Organization and the UN Disaster Relief Organization have developed their own specialized networks to support their ongoing activities. In addition, the Organization of American States (OAS) sponsors a number of low-budget projects that aim to foster networking in Latin America. International nonprofit organizations, such as ECOnet, have likewise contributed to the development of global networking.

U.S. Aid for Telecommunications

Finding precise figures for U.S. expenditures on telecommunication-related aid projects is very difficult (see appendix B for an overview). Funding is generally dispersed through different agencies, geographic bureaus, and applied aid projects—such as energy or health care—where the telecommunication component may be hidden.[152] Moreover, because the rationale for funding varies according to the goals of specific projects, it is difficult to generalize from one project, or region, to the next.

Funding by region runs almost in parallel with that of the multilateral banks. Over the last few

[150] Ibid., p. 91.
[151] *Communication of the ACM*, August 1994, op. cit., footnote 28.
[152] Ibid.

years, the Eastern European bureau within the U.S. Agency for International Development (USAID) has spent approximately $2 million per year on telecommunication related projects.[153] On the other hand, USAID does not formally designate any telecommunication related aid for Latin American.

United States telecom-related aid projects also reflect the general shift in the direction of U.S. aid policy, which occurred in the mid-1980s, from a "basic needs approach" to one focusing on structural economic adjustments.[154] As can be seen in box 4-7, of the six telecom projects being sponsored by USAID in Eastern Europe and the Newly Independent States, only one involves technology deployment. Five programs aim to promote and facilitate structural changes in the telecommunication regulatory environment, while the remaining program is designed to help defray the high cost to U.S. companies of developing telecommunications projects in this area. The State Department's telecommunications program similarly focuses on structural telecommunication reforms.

Implications for Developing Country Networking

Communication and information technologies can have far-reaching consequences. They not only affect relationships of time and space; they also help to structure social and economic organization, as well as values.[155] If information networking technologies are to serve Third World development needs, they must be made available in a timely fashion; equally important, however, they must be deployed in a manner that is consistent with economic development goals.

In a networked-based global economy, communication needs are relative, and timing is everything. Where networks are involved, "first movers" generally have a major advantage, and technology laggards are often left behind. It is, in fact, precisely for this reason that those developing countries aspiring to use information technology to "leap frog" beyond the industrial era to prominence in the information age are in a heated race with one another to deploy networking technologies.

Patterns of network diffusion are likewise critical. If diffusion is uneven, and network quality unequal, networking technologies will likely serve to reinforce, instead of diminish, social and economic disparities within and among countries throughout the world. In places where network modernization trails too far behind, community residents will be unable to link up to critical communication facilities such as educational and healthcare centers or networked business enterprises. To interconnect efficiently, communication networks must be comparable.

Network architecture must also be supportive of economic development goals and strategies. Technology choices and the way in which they are arranged, distributed, and interconnected will determine who is able to communicate, under what conditions, and how effectively. Thus, for example, if future development strategies place greater priority on promoting productivity in agriculture—as is the case today in China—networks must be designed to ensure rural access.

In the past, governments played a key role in shaping their national infrastructures to serve economic and political goals. In a highly competitive, global economy, this option is no longer tenable. As described above, national telecommunication rules and regulations are easily bypassed. And in many cases, developing countries are rapidly dismantling them, in an effort to compete for global business.

In a global economy, which is highly dependent on networking, multinational businesses will necessarily be the major drivers of technology. As already noted, these businesses and financial interests are competing intensely with one another to finance and build facilities in the most lucrative, developing country markets. In this open, market-driven environment, technology diffusion can be expected to follow the same

[153] More precise figures were unavailable.
[154] See chap. 2 for detailed description of this shift in aid policy.
[155] See chap. 3 for a discussion of the relationship between communication technology and social and economic outcomes.

BOX 4-7: U.S. Agency for International Development (USAID) Telecommunications Projects in Central and Eastern Europe and the Newly Independent States

USAID telecommunications-related assistance to countries in Central and Eastern Europe and the Newly Independent States (NIS) has averaged approximately $2 million per year in recent years. Some of the programs described below were conducted in conjunction with the U.S. Department of State. Program descriptions adapted from USAID documents are provided below.

Newly Independent States Regional, FY 1993–1994

State Department/cip Telecom Assistance Program—Program organized telecommunications seminars on basic telecommunications legislation, tariff regime, mobile communications, packet switching, and regulatory issues.

Central and Eastern Europe Regional, FY 1992–1995

Joint State/aid Telecommunications Policy, Law, and Regulations Program—Program organized seminars on telecommunications regulations and spectrum management. Also provided funding through the U.S. Trade and Development Agency for major policy/legal framework studies in Hungary.

Capital Development Initiative Telecom—Through an intensive program of policy interventions, this program aims at fostering the development of telecommunications infrastructure in Central and Eastern European countries through creation of a business environment conducive to private investment in telecommunications and promotion of U.S. private investment in developmental telecommunications projects.

Central and Eastern Europe Regional, FY 1993–1994

Development Cost Support Grants—Program awarded grants competitively to U.S. companies to help defray on a cost sharing basis the high expenses of telecommunications project development in Central and Eastern Europe.

Rural Telephone Cooperative Development—Program supports the U.S. National Telephone Cooperative Association (NTCA) rural telephone development activities in Poland under grants from USAID. Two telephone cooperatives assisted by NTCA are in operation. NTCA contributed significantly to the acceptance of private ownership of telephone operations in Poland.

Grant For U.S. Telecommunications Training Institute, Telecommunications Training Program—Grant brought dozens of telecommunications managers to the United States for telecommunications training donated by U.S. telecommunications companies through the U.S. Telecommunications Training Institute.

SOURCE: Information provided by U.S. Agency for International Development, January 1995.

hierarchical pattern that characterized the evolution of communication networking in the past.

THE NEED FOR TELECOMMUNICATION-RELATED AID POLICIES THAT SUPPORT U.S. TRADE GOALS

The shift toward a liberalized, global communication environment affords a number of opportunities for the United States. The prospects for increased trade in equipment and services are particularly great, given technology convergence and the development of a wide array of new products and services, the growth in worldwide demand, the provisions for telecom services within the GATT, and the liberalization and privatization of many telecommunication regimes. Foreign manufacturing and investment opportunities will also abound, as developing countries adopt new technologies to modernize and upgrade their communication networks. Glo-

bal communication networks may also serve to promote worldwide economic growth and development, by allowing businesses to reconfigure and redistribute their research and development, production, and marketing activities to their best advantage regardless of their geographic location.

In this interdependent global environment, the United States has an interest—both from an economic as well as a foreign policy perspective—to help ensure that Third World countries are not left behind. When networks are extended and linked together, in the early stages of their development, everyone gains. A network's value increases with the number of users, as does the demand for equipment and services. Moreover, in an information, networked economy, electronic networks serve to channel the flows of trade and investment, much as railroads, telephones, and highways influenced the course of business in the industrial age. If U.S. businesses can not interconnect with Third World networks, they will have less opportunity to compete in these rapidly growing markets. Moreover, they will be unable to globally reconfigure their businesses to take advantage of low-cost labor and resources.

In the past, there was only one way to build a network—hierarchically and all of one piece. Today, this is no longer the case. Taking advantage of the higher performance and enhanced variety of new communication technologies, as well as the much greater flexibility that they afford, new small scale "bottom up" networking solutions can be developed to extend services to people and places that—in an increasingly liberalized regulatory environment—might otherwise go unserved.

The United States can promote both its foreign aid and trade goals by helping Third World countries to develop grassroots networking in remote areas. Infrastructure related aid projects have generally had a high pay off. At the same time, experience has shown that it is this type of aid project that is most likely to stimulate trade. Bottom-up networking can also support the kind of comprehensive, "holistic" development strategies that have proven essential for sustainable growth. For example, if grassroots networks are set up by local people, using their own labor and resources, they can serve to promote entrepreneurship, stimulate local activity, and reinforce community ties. Given the wide range of technologies now available, local networks can also be customized to match the needs and resources of specific areas. Equally important, these networks will not compete with, but instead will complement and add value to, the information networks that are presently being deployed in high density areas. As an added benefit, given network growth in unserved areas, Third World governments will likely be under less pressure to use subsidies to promote universal access, and hence more willing to promote regulatory reforms and open their markets to U.S. equipment and service providers.

Appendix A: An Historical Analysis Relating Causes to Effects

A

Given the complexity of the relationships involved, anticipating how communication technologies might affect the prospects of Third World countries is decidedly difficult. Nonetheless, to make sound telecommunication investments, developing country leaders and foreign aid providers must assess the full range of associated benefits and costs. They also need to understand the conditions under which success will most likely occur.

To gain a sufficiently broad understanding of these issues, it is useful to consider historical evidence drawn from analogous situations. Only an historical picture can capture all the variables and their relationship to one another. Comparing historical inferences to statistical data, it is then possible to suggest whether, and the extent to which, the conclusions of such analyses might be generalized.

To select an historical case that is somewhat analogous to the situation in developing countries today, one need look no further than the United States. Judged by European standards of the time, the United States was, in its earliest years, "underdeveloped." By the turn of the 19th century, however, the United States had been forged into a major industrial nation spanning the continent and a multiplicity of cultures. Telecommunications, as described below, played a major role in this economic and political transformation.

COMMUNICATION TECHNOLOGY AND THE RISE OF THE U.S. ECONOMY

The important role that communication (and transportation) technologies played in the rise of the U. S. economy can be seen by tracing the development of these technologies in conjunction with the nation's industrial development. Between 1830 and 1887, a plethora of new technologies emerged and gradually replaced many of the social and institutional communication networks that had hitherto sustained economic activities in the New World. The deployment of these technologies, together with the social and organizational changes that they facilitated, increased economic activity and fostered economic growth in a number of interrelated ways (see table A-1).

TABLE A-1: Selected Innovations in More Generalized Information-Processing and Computing Technologies, 1880–1939

Year	Desk-top calculating	Digital computing	Analog computing	Punch-card processing
1880				
1882				
1884	Keyboard			Electric
1886	add-subtract			tabulator
1888	calculator	Part of		
1890	Multiplier	analytical		
1892		engine		
1894	Four-		Equation	
1896	function		solver	
1898	calculator		80-element	Automatic
1900			harmonic	bin sorter
1902			analyzer	Plug-board
1904				tabulator
1906				
1908				
1910			Gyrocompass	
1911			computer	
1912			Profile	
1913			tracer	
1914		End-game	80-input tide	
1915		chess machine	predicator	
1916			Battle	
1917			tracer	
1918				
1919				Printing
1920		Electro-		tabulator
1921		mechanical		
1922		calculator		
1923				Electric
1924	Electric		Product	keypunch
1925	printing		integraph	
1926	calculator			
1927			Electric	
1928	Multiple-	Calculators	network	80-column
1929	register	linked as	analyzer	punch
1930	cumulating	difference	Differential	card
1931	calculator	engines	analyzer	
1932				
1933		Mechanical		Punch card
1934		programmer		accounting
1935			Electrical	machines

(continued)

TABLE A-1: Selected Innovations in More Generalized Information-Processing and Computing Technologies, 1880–1939 (Cont'd.)

1936			analog	linked for
1937			computer	computing
1938			Electronic	
1939	Electronic calculator	Bell Labs Model I	analog computer	

SOURCE: James R. Beniger I, *The Control Revolution: Technology and Economic Origins of the Information Society* (Princeton, NJ: Princeton University Press, 1986), p. 400–401.

From the 15th century until the development of the railroad and the telegraph in the last half of the 19th century, material goods were transported very slowly—at the speed of draft animals if they traveled by roadway or canal, or "at the whim of the winds" if they traveled by sea.[1] Because transportation and communication over long distances was difficult and slow, trade was discouraged and markets were geographically limited in size. At such distances, merchants did not have a great deal of information on which to base their sales. Prices differed significantly from market to market and considerably exceeded the costs associated with distribution. As a result, most merchants refrained from long-distance trading. When they did engage in such trade, they generally remained at home, relying on merchants in other trade centers to sell their goods on a commission basis. To minimize and spread the sizable risks involved, they sold a wide variety of products rather than specializing.[2] Given the 4-month lag in transatlantic communication, as well as European mercantilist policies, trade between the American colonies and Great Britain was generally limited.

Although the speed of transportation and communication did not greatly increase in post-revolutionary America, the volume of trade did grow as a commercial infrastructure was gradually established, and as more effective means of transportation and communication were deployed.[3] Equally important to the development of trade was the establishment of a network of people who, in their various roles as middlemen, helped to convey market information and goods across both the North American continent and the Atlantic Ocean. Included among them were shippers, financiers, jobbers, transporters, insurers, brokers, auctioneers, and retailers.

The impacts of these developments were cumulative. Trade gave rise to more trade. As markets expanded, so did the density of merchant exchange networks and the amount of available market information. As a result, distribution costs declined, and merchants were further encouraged to engage in trade. Moreover, with larger markets and better information, merchants faced fewer risks, and thus they were able to specialize in particular aspects of trading such as importing, wholesaling, retailing, or exporting. This increased specialization led, in turn, to greater coordination of markets and reduced costs, making trade even more attractive.[4]

The positive effect that increased information exchange had on trade was clearly exhibited, for example, with the development of the transatlan-

[1] James R. Beniger, *The Control Revolution: Technology and the Economic Origins of the Information Society* (Cambridge, MA: Harvard University Press, 1986), p. 219.

[2] Ibid.

[3] The commercial infrastructure was comprised of commercial banks (1780s), a federal banking system (1791), State insurance regulations (1799), federal bankruptcy law (1800), and joint stock companies (1810). The new technologies included a federal postal service (1791), the first turnpike (1795), coastal steamboat travel (1809), mail delivery by steamboat (1813), regular packet service to England (late 1810s), steam railroads and Atlantic clipperships (early 1830s), local postal delivery service (1836), regular transatlantic steamship service (1847), and regular steamboat to California (1849). Ibid., p. 130.

[4] Ibid.

tic cable in 1866. Before the completion of the Atlantic telegraph, New York financiers were unwilling to trade in London markets, unless prices were very attractive, because it took six weeks to clear prices and have their orders executed there. The completion of the undersea cable radically changed the situation, bringing about an immediate convergence of prices on both sides of the Atlantic.[5]

Also critical to the growth of markets was the development of mass media technologies such as power-driven, multiple rotary printing and the national postal system. By drawing audiences into larger and larger communities, these technologies accelerated the marketing of consumer goods on a national scale. The increased use of syndicated material in newspapers and the advent of nationally circulated magazines in the late 1800s anticipated true mass communication.[6] Catalogs also became popular as an advertising medium. In 1887, Montgomery Ward distributed nationally a 540-page catalog that offered more than 24,000 items for sale.[7]

Despite the development of national markets and greatly increased trade, specialization and rationalization of production was limited until the late 1800s by the relatively low speed of transportation and communication technologies. Specialization can only take place, and productivity can be increased only to the extent that goods can be moved, processed, and distributed, and that the production process itself can be coordinated.[8] It was only with the development of the railroads in the 1830s and the telegraph in 1844 that the requisite speed and control in the processes of production and exchange could be achieved. By increasing the speed of communication and extending the range of possible control, the railroad, the telegraph, and later the telephone facilitated the growth of large-scale organizations with modern management structures, a first step in the centralization of production and distribution.[9]

Given the speed of the new technologies, the growth of the modern corporation was not limited by national geographic boundaries. Employing communication technologies to coordinate their activities, a number of these new enterprises invested abroad in what proved to be very successful international ventures.[10]

Although communication technologies affected all economic relationships, their impact was not distributed equally nor experienced uniformly. As Joseph Schumpeter has pointed out, technology gives rise to economic growth through the process of "creative destruction."[11] Thus, although the economy as a whole prospered as a result of communication and information technologies, some sectors of society found themselves worse off.

For example, the invention of the telegraph served, in some cases, to diffuse economic power. In the early history of the United States, New York City was able to capitalize on its position as a national information center to become the center of worldwide trade.[12] News continued to flow faster and more fully in and out of New

[5] Kenneth D. Garbade and William L. Silber, "Technology, Communication, and the Performance of Financial Markets 1840-1975," *Journal of Finance*, vol. 33, June 1978, pp. 819–832.

[6] Theodore Peterson, *Magazines in the Twentieth Century* (Urbana, IL: University of Illinois Press, 1964, 2d ed.).

[7] Beniger, op. cit., footnote 1, pp. 18–19.

[8] Ibid., p. 208; and Alfred D. Chandler, Jr., *The Invisible Hand: The Managerial Revolution in American Business* (Cambridge, MA: Harvard University Press, 1977).

[9] Ibid., and Beniger, op. cit., footnote 1. Before the development of these technologies, businesses were usually run by their owners who, focusing on a single line of products, generally operated either a single unit of production or a single unit of distribution. There were only a few salaried managers who typically worked directly with the owners. Alfred D. Chandler, Jr., "The Evolution of Modern Global Competition," Michael E. Porter (ed.), *Competition in Global Industries* (Boston, MA: Harvard Business School Press, 1986), p. 405.

[10] For a description of these undertakings see, Porter, op. cit., footnote 9.

[11] Joseph Schumpeter, *The Theory of Economic Development*, trans. by R. (Cambridge, MA: Harvard University Press, 1934).

[12] See Ronald F. Abler, "The Geography of Communications," Michael Eliot Hurst (ed.), *Transportation Geography: Comments and Readings* (New York, NY: McGraw-Hill, 1974).

York than any other city, giving it a strong economic advantage. Southern cities, in fact, communicated faster with New York City than within their own region, a fact that engendered increasing resentment in the South for cultural as well as economic reasons.[13] With the invention of the telegraph, however, New York's central position in the national market began to erode. The opening of the New York-Philadelphia Line enabled brokers in one city to learn prices in the other, and to place orders before the market had closed. Similarly, prices in other distant markets, such as western grains, also became items of trade through instantaneous communication.[14]

Communication technologies also served to undermine the middleman's role in the wholesale trade. As marketing tasks were vertically integrated together in large-scale firms, the middleman's function of transmitting and distributing market information and goods was no longer required. The new mass retailers, such as department and chain stores as well as mail-order houses, could use technology to circumvent wholesalers, purchasing from manufacturers directly and thereby reducing their costs.[15]

The new technologies also favored large firms at the expense of small ones, contributing to the growth of oligopoly.[16] As the scale of operations also grew, size served as a barrier to entry because most small firms lacked the resources needed to function nationally or regionally. With the development of national advertising, the small, local retailers, who had once served their communities with little competition, found themselves facing a succession of challengers—department stores, mail order firms, and chain stores.

Rural areas were hit particularly hard because advances in transportation and communication technologies were linked to the decline of agriculture and the corresponding rise of industrialization. By extending their ties and expanding their markets, communication technologies made rural communities less self-sufficient and more vulnerable to external developments and events over which they had little control.[17] Industrialization, for example, brought with it new kinds of problems, with which increasingly smaller

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[13] See Robert Albion, The Rise of New York Port, 1815–1939 (New York, NY: Charles Scribner's Sons, 1939); and Allen Pred, "Urban Systems Development and the Long Distance Flow of Information Though Preelectronic U.S. Newspapers," *Economic Geography*, vol. 47, October 1971, pp. 498–524.

[14] See Garbade and Silber, op. cit., footnote 5, and Richard DuBoff, "The Telegraph and the Structure of Markets in the United States," *Research in Economic History*, vol. 8, 1983. As Duboff notes with respect to the cotton market, "Data on cotton prices in New York show diminishing fluctuations over time. The average spread between lowest and highest prices narrowed steadily, except during the Civil War and its aftermath, and the steepest decline in high-low price ranges and dispersion of prices from decade averages came in the 1850s—'the telegraph decade.' as it might well be called." Richard Duboff, "The Telegraph and the Structure of Markets in the United States," *Research in Economic History*, vol. 8, 1985, p. 257.

[15] As Beniger notes, "Between 1869 and 1879 the ratio of wholesale to direct sales rose to 2.40 from 2.11, with only $1 billion worth of goods passing directly from manufacturers to retailers in the latter year, while some $2.4 billion worth went by way of wholesalers. After 1889, however, when wholesaling's predominance had already declined slightly to 2.33, the ratio began to fall ever more sharply: to 2.15 in 1899, to 1.90 in 1909, and to 1.16 by 1929." Beniger, op. cit., footnote 1, p. 258.

[16] As described by DuBoff, "...The telegraph dramatically enlarged information networks; it saved time, reduced the need for large inventories, decreased financing requirements, and prompted elimination of middlemen. But 'competition' and 'monopoly' are not, as neoclassical theory implies, polar opposites. The telegraph improved the functioning of markets and enhanced competition, but it simultaneously strengthened forces making for monopolization. Large-scale business operations, secrecy and control, and spatial concentration were all increased as a result of telegraphic communication." Richard DuBoff, op. cit., footnote 14.

[17] For the classic discussion of how communication technologies can disadvantage local, vis a vis metropolitan, areas, see Harold Innis, *The Bias of Communication* (Toronto: University of Toronto Press, 1951). According to Innis, communication technologies that served to overcome the barrier of distance and time tended in the long run to make rural areas overly dependent on urban centers. As James Carey notes with reference to Innis' work "Innis attempted to show how localities and regions resisted the spread of communication, how the relationship was decided by a protracted series of conflicts over the spread of standard time, the mail order house, parcel post and rural free delivery, the department store and the regionalized corporation." See James W. Carey, "Space, Time, and Communications: A Tribute to Harold Innis," James W. Carey (ed.), *Communication as Culture: Essays on Media and Society* (Boston, MA: Unwin Hyman, 1989), p. 143.

farm communities could not deal.[18] To meet these developing needs, new towns and trade centers emerged, located at a reasonable traveling distance from farm communities. Taking advantage of improved transportation and communication networks, these centers were, in turn, linked more and more to urban areas, leaving rural areas to fend for themselves.[19]

Notwithstanding the problems associated with the deployment of communication technologies, rural areas could not have afforded to forgo them, for the shifts in the national economy were not accidental. They were closely associated with the development of regional and national infrastructures, and a rural area's proximity to these trade networks proved to be a critical factor in determining its ability to survive.[20]

As is clear from this historical account, communication technologies contributed to growth in the United States in a number of interrelated ways, many of which served to reduce transaction costs. First, communication technologies dramatically increased both the speed and the number of economic transactions that could take place. Second, by diminishing the relevance of geographic distance, communication technologies facilitated the expansion of trade and markets. At the same time, the development of mass media technology served to reinforce national markets by helping to mold tastes and preferences into a more uniform cast. In turn, this increased market size led to greater specialization, standardization, and economies of scale. By enhancing intrafirm coordination, communication technologies allowed businesses to grow vertically and horizontally, and thus to exploit these economies.

Communication technologies also served to restructure relationships among economic actors, making some better and some worse off. Most vulnerable were whose who were either replaced, or bypassed, by technology. Winners were those who, being the first to gain access, were able to use communication technologies to reorganize their activities in response to the fundamental social and economic changes entailed in the process of industrialization, thereby gaining competitive advantage.

This brief account of U.S. economic development also highlights that the role of communication technologies was not constant over time. Rather, it increased along with technology advance and as markets grew and business processes became more complex and information intense. Initially, for example, middlemen and their personal networks provided the medium by which market information was transported, and market interactions consisted almost entirely of face-to-face exchanges. With the onset of industrialization, mediated communication replaced most of this primary contact.

COMMUNICATION TECHNOLOGY AND THE EVOLUTION OF POLITICS IN THE UNITED STATES

Just as communication technologies served to promote U.S. economic growth and development, so too they played a critical role in the political evolution of the United States. Like political leaders in many developing countries today, the U.S. Founding Fathers were faced

[18] According to Swanson, rural communities were "self-contained production units." However, with industrialization, "Previous social formations, such as the rural church or the one room six grade schoolhouse, gave way to the demands of new industrial employers and regional and national trade. Rural schools were not expected to prepare children for the financial and technical demands of a rapidly industrializing agriculture and nonfarm sector. Local socioeconomic networks such as cooperative harvesting (and risk taking) and quasi-barter exchange systems that mediated local production and consumption under non-commercial conditions were gradually subordinated to and/or eclipsed by new institutions," See Louis Swanson, "Rethinking Assumptions About Farm and Community," in A.E. Luloff and Louis E. Swanson (eds.), *American Rural Communities* (Boulder, CO: Westview Special Studies in Contemporary Social Issues, 1990), p. 22.

[19] Ibid.

[20] As one observer described in 1850: "[Business merchants, farmers, bankers, shippers, and others soon learned the] great advantages of this mode of instantaneous communication of intelligence [which] is with them not so much as a matter of choice as of necessity, for, without availing themselves of it, they must necessarily be behind in that which is essential to the success of their business." As cited in Ibid., p. 21.

with the mammoth task of "building" a nation in the context of a democratic political system. At a minimum, this effort entailed establishing national sovereignty and national security; maintaining internal security and social welfare; and assuring an open political system based on participation, deliberation, and representation.[21] Communication technologies, and the rules that governed their use and development, were critical not only to carry out these activities, but also in determining the relationship—as well as resolving the tensions—among them. Serving as a mechanism for both national integration as well as individual (and group) differentiation/participation, these technologies provided a mechanism for balancing the need for political participation as well as social control.

Political activities not only depend on communication; they also require constraints on the manner in which communication occurs. Thus, those in powerful positions have always attempted to control, or even restrict, access to communication pathways.[22] While limitations on communication may not accord with some characterizations of democracy, many political theorists have argued, in fact, that constraints on participation are necessary in order to preserve democracy. Aristotle, for example, favored "constitutional government" but was opposed to "direct democracy," which he called perverted because it failed to protect the rights and interests of the minority.[23] James Madison made much the same case in Federalist Paper 10, when he argued on behalf of "a government in which a scheme of representation takes place." Accordingly, democracy can be said to depend on the establishment of a delicate balance between "too little" and "too much" political communication.

In negotiating this balance, "communication gatekeepers" play a critical role.[24] Gatekeepers are the individuals or groups in a society that determine who makes decisions about the flow of information and knowledge. How, and to whom, the role of communication gatekeeper is assigned varies across cultures, in different historical contexts and organizational settings. Technological developments can also determine where and how gatekeeping takes place, and who will assume the role.

In the United States, the role of communication gatekeeping was established early in American history. Fully appreciating the role that communication could play in forging a cohesive nation state, the Founding Fathers were, at the same time, deeply aware of its potential for disruption. Three years before the Declaration of Independence, they had—as "revolutionaries"—wrested control of the posts from the British.[25] Setting up a "Constitutional Post," which transmitted news from New Hampshire to Virginia,

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[21] The United States was designed to be a representative or republican form of government. This design reflects the Founders' belief that, while government should be based on popular sovereignty, it should also protect the minority against majority rule. Thus, while power was given to the people, it was done in a limited, or restricted, fashion. Qualified participants were defined narrowly to include only white, property-owning males. Moreover, the President and the Senate were not directly elected by the people but rather were indirectly chosen by the Electoral College and the state legislatures. And finally, "the people" were themselves divided into two constituencies—one at the federal and one at the state level.

[22] As Donohue et al. have noted, "When man devised the first rudimentary form of mass communication centuries ago, he immediately developed ways of controlling it. Printer, king, teacher and merchant were almost equally inventive in contriving ways to bring information under control. Their diligence arose from man's historic recognition of a fundamental social principle: knowledge is basic to social power." See George A. Donohue, Phillip J. Tichenor, and Clarice N. Olien, "Gatekeeping: Mass Media Systems and Information Control," F. Gerald Kline and Phillip J. Tichenor (eds.), *Current Perspectives in Mass Communication Research* (Beverly Hills, CA: Sage Publications, 1972).

[23] *Aristotle in Twenty-Three Volumes, XXI Politics*, translated by H. Rackham (London: Heinemann, 1977), book III, p. 207.

[24] The term "gatekeeper" is borrowed from the field of journalism. For a discussion see D. M. White, "The Gatekeeper: A Case Study in the Selection of News," *Journalism Quarterly*, vol. 27, fall, 1950, pp. 383–390.

[25] Newspapers and pamphlets served as the primary vehicles for public protest and revolt, providing a network of political communication that was crucial to revolutionary activities. And, with the revolution, printers, functioning as editors and publishers, took on a key role. In fact it was in their shops that many a political story and idea were exchanged. See Richard Buel, Jr., "Freedom of the Press in Revolutionary America: The Evolution of Libertarianism, 1760–1820," Bernard Bailyn and John B. Hench (eds.), *The Press and the American Revolution* (Worcester, MA: American Antiquarian Society, 1980), pp. 59–97; and Frank Luther Mott, *American Journalism* (New York, NY: Macmillan Co., 1941).

they sought to fuse the colonies into a unified whole.[26]

This respect for the power of the pen, together with concerns about its ability to foment opposition, may account for the reluctance of the Constitution's authors to let journalists interpret the events of the Constitutional Convention for the public. For while prohibiting newspaper coverage of the proceedings, they themselves made very effective use of newspapers and other communication outlets to build support for the ratification of the Constitution. Disguised as the columnist Publius, Alexander Hamilton, John Jay, and James Madison wrote a series of newspaper articles on behalf of the Constitution. These *Federalist Papers* proved critical in generating public understanding of, and support for, the new government.

Taking a longer term view, the Founding Fathers also recognized that building a nation required the development of a unified market, the forging of a common culture, and the creation of a democratic polity. And they believed that the widespread flow of communication was essential to these tasks. Arguing that open communication was required to maintain a pluralistic society, James Madison wrote, for example:

> Popular government without popular information, or the means of acquiring it, is but a prologue to a farce or tragedy, or perhaps both. Knowledge will forever govern ignorance, and a people who mean to be their own governors must arm themselves with the power which knowledge gives.[27]

To foster such communication, the Founding Fathers incorporated three important provisions in the Constitution. These included the First Amendment provision for free speech; the authorization of intellectual property protection under Article 1, Sec. 8; and Article 1, Sec. 8, Paragraph 7, which gives government the power to establish post offices and postal roads.[28] Moreover, as early as 1792, both political parties agreed that the government should subsidize newspapers. [29]

The Founders, it should be added, were also well aware of the more pragmatic aspects of political communication. Recognizing their own needs to communicate with constituents, the Members of the First Continental Congress granted themselves free postage, a privilege that was continued after the Constitution was adopted.

Communication was intended not only to integrate the nation; it was also expected to foster diversity, providing individuals and groups a means to join together to express and promote their views. It was believed that the only way to guard against domination by a majority faction was to promote a large number of diverse competing ones.[30] Writing to Thomas Jefferson, James Madison summed up this view:

> *Divida et impera*, the reprobated axiom of tyranny is, under certain qualifications, the only policy by which a republic can be administered on just principles.[31]

Americans were well suited to play this role.[32] From the outset of the new republic, they demonstrated a penchant for joining factions and establishing associations, a trait that did not escape the observation of Alexis de Tocqueville when he visited American in the mid-1800s. As he described in *Democracy in America:*

> Nothing...is more deserving of our attention that the intellectual and moral associations of

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[26] Ward L. Miner, *Goddard: Newspaperman* (Durham, NC: Duke University Press, 1962), pp. 111–136.

[27] Saul K. Padover (ed.), *The Complete Madison: His Basic Writings* (Millwood, NY: Kraus Reprint, 1953), p. 337.

[28] See Ithiel de Sola Pool, *Technologies of Freedom* (Cambridge, MA: The Belknap Press of Harvard University, 1983), pp. 16–17.

[29] *Inside Congress* (Washington DC: Congressional Quarterly, 1979), p. 127.

[30] See Marc F. Plattner, "American Democracy and the Acquisitive Spirit," in Robert A. Goldwin and William Sebambu (eds.), *How Capitalist is the Constitution?* (Washington, DC: The American Enterprise Institute, Constitutional Studies Series, 1982), chap. 1.

[31] James Madison to Thomas Jefferson, Oct. 24, 1787, Galliard Hunt (ed.), *The Writings of James Madison*, 9 vols. (New York, NY: G.P. Putnam's Sons, 1906), as cited in Ibid.

[32] For cross cultural comparisons, see Robert Wuthnow (ed.), *The Voluntary Sector in Comparative Perspective* (Princeton, NJ: Princeton University Press, 1991).

> America. Americans of all ages, all conditions, and all dispositions constantly form associations. They have not only commercial and manufacturing companies, in which all take part, but associations of a thousand other kinds, religious, moral, serious, futile, general or restricted, enormous or diminutive. [33]

In promoting their activities, these burgeoning groups and factions took advantage of improvements in printing technology and the postal delivery system. Political groups, for example, used newspapers both to foster party cohesion, and to disseminate the party's perspective to outlying communities."[34] At the same time, taking advantage of postage-free printers' exchanges, the party papers received political information from States and localities. Thus, their editors helped to synthesize a national political community that transcended local orientations.[35] The various social movements of the 19th century developed similar communication mechanisms to advance their causes.

Despite this growth in social and political communication, the United States remained a society of "island communities"—cities and towns with limited interaction—throughout most of the 19th century.[36] One constraint on national integration was the failure of the communication infrastructure to keep pace with the nation's geographical and cultural expansion. Before the advent of the railroads and the telegraph, the postal system provided the primary bridge that connected a population that was increasingly dispersed and socially differentiated.

Resistance to cultural intrusion—made possible by communication—also played a role in inhibiting national integration. Notwithstanding their desire to have access to national news and market information, many communities resisted the potential economic and cultural influence that was associated with them.[37] Improvement in communications thus gave rise to a cultural debate about how to foster national integration through communication without undermining the viability of local communities. These cultural issues exacerbated the growing conflict between the North and the South, which led ultimately to the collapse of the union and the outbreak of civil war.

The Civil War lasted four years and took 600,000 lives. It signaled a breakdown in the legitimacy and hence control of the political system, as well as its failure to effectively manage conflict among competing interests. In the aftermath of the war, the need to integrate the nation and to build consensus was as great, if not greater, than before.

As in the early years of the Republic, political leaders in the Reconstruction Period looked to communication and transportation to bind the nation. Even before the Civil War had ended, Congress passed the Morill Act and the Pacific Railroad Act, which provided land grants to both higher education and transcontinental railroads. This aid was considered by most Americans "as an investment in national unity and economic growth that would benefit all groups in society."[38]

Publicly supported education was also promoted at the community level. This commitment

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[33] Alexis de Tocqueville, *Democracy in America* (1963 ed.), as cited in U.S. Congress, Office of Technology Assessment, *Global Standards: Building Blocks for The Future* (Washington DC: U.S. Government Printing Office, 1992), p. 46.

[34] William Chambers, *Political Parties in a New Nation* (New York, NY; Oxford University Press, 1963), p. 42.

[35] As Kielbowitz points out, print communications remained relatively open throughout the 1800s, largely because of government efforts to ensure access. Subsidized postage rates allowed readers to subscribe to distant publications. Any town with a newspaper and post office could become a source of news for the rest of the Nation. See Richard B. Kielbowitz, "News Gathering by Printers' Exchanges Before the Telegraph," *Journalism History*, vol. 9, summer 1982, pp. 42–48; and Samuel Kernell, "The Early Nationalization of Political News in America," *Studies in American Political Development* (New Haven, CT: Yale University Press, 1986), pp. 255–278.

[36] Robert Wiebe, *The Search for Order, 1877-1920* (New York, NY: Hill and Wang, 1967), p. xiii.

[37] As described by McPherson, "Southern self-condemnation of this 'degrading vassalage' to Yankees became almost a litany during the sectional crisis from 1846 to 1851. 'Our whole commerce except a small fraction is in the hands of Northern men,' complained a prominent Alabaman in 1847. 'Take Mobile as an example—7/8 of our Bank Stock is owned by Northern men...Our wholesale and retail business—everything in short worth mentioning is in the hands of men who invest their profits at the North... Financially we are more enslaved than our negroes." James M. McPherson, *Battle Cry of Freedom: The Civil War Era* (New York, NY: Oxford University Press, 1988), p. 92.

[38] McPherson, op. cit., footnote 37, pp. 451–452.

to public schooling was, in fact, so intense that it gave rise to a national crusade.[39] Concerned about the problems of reconstruction in the South, the influx of Catholic immigrants, and the advent of industrialization in the North, Americans saw public schooling as a way of preserving the social, economic, and political system. By educating American youth in public schools, they hoped to inculcate them with a common set of patriotic, Protestant, and republican values.[40]

With the industrialization and urbanization of American society, it was expected that schooling would serve not only to prepare American youth for a common political role as citizens, but also to prepare a growing number of people from increasingly different social, economic, and ethnic backgrounds for an increasingly differentiated set of economic roles. To perform this economic function, the public schools were restructured in accordance with business principles.[41]

These efforts to promote national integration were reinforced by continual advances in communication technologies, which greatly improved their prospects for success. In the last half of the century, new media and media distribution channels were developed, making it possible to communicate on a national scale. These included the telegraph, nationally distributed magazines, motion pictures, the telephone, and radio.

The telegraph helped to homogenize social existence across the nation. Because of high costs, the telegraph was initially used solely by businesses and the press; few people used it for social communication, at least in the United States.[42] However, the impact of the telegraph was experienced more broadly. By fostering the standardization and the central processing of news reports, the telegraph allowed Americans to share common accounts of the "latest" national and international news stories.[43] Delivered by fast trains, weekly editions of metropolitan newspapers shaped the political sentiments of farmers a thousand miles away.[44]

The telegraph also served to standardize the routine of people's daily lives. Before the railroad and telegraph, society's "island communities" geared their time to local rhythms. For example, Michigan had 27 time zones, Indiana 23, and Wisconsin 39. The advent of the railroad required the coordination of schedules over large areas, and conducting business via telegraph required knowledge of precise times around the world.[45]

The national distribution of inexpensive popular magazines also fostered national integration. Entrepreneurs launched national magazines in the 1880s and 1890s expressly to serve as vehicles for advertising brand name consumer items featured by mass retailers.[46] This new genre of

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[39] Bernard Bailyn, *Education in the Forming of American Society* (New York, NY: W.W. North, 1980); and Lawrence A. Cremin, *Traditions in American Education* (New York, NY:Basic Books, Harper 1976).

[40] Rush Welter, *Popular Education and Democratic Thought in America* (New York, NY: Columbia University Press, 1962); and David Tyack and Elisabeth Hansot, "Conflict and Consensus in American Public Education," *America's Schools: Public and Private, Daedalus*, summer 1981; Robert A. Carlson,. *The Quest for Conformity: Americanization Through Education* (New York, NY:John Wiley & Sons, 1975); "Public Education as Nation Building in America: Enrollments and Bureaucratization in the American States 1870–1930," *American Journal of Sociology*, vol. 85, No. 3, November. 1979.

[41] David K. Cohen and Barbara Neufeld, "The Failure of High Schools and the Progress of Education," *America's Schools: Public and Private, Daedalus*, summer 1981; Sol Cohen, "The Industrial Education Movement, 1906–1917," *American Quarterly*, spring 1968, pp. 95–110; and Martin Trow, "The Second Transformation of American Secondary Education," *International Journal of Comparative Sociology*, vol. 7, 1961.

[42] In European countries, where the telegraph was a government monopoly supervised by the postal authorities, people made greater use of the wires for personal correspondence.

[43] Before the telegraph, editors obtained nonlocal news through the mails essentially cost free. They culled their exchanges and selected accounts deemed suitable for local readers. News-gathering by wire, in contrast, entailed more costs; press associations, such as the New York Associated Press, were organized to spread the expense of news-gathering and transmitting among many users. See F.B. Marbut, *News From the Capital* (Carbondale, IL: Southern Illinois Press, 1971).

[44] McPherson, op. cit., footnote 37, pp. 12–13.

[45] James Carey, "Technology and Ideology: The Case of the Telegraph," *Prospects*, vol. 8, 1983, pp. 303–325.

[46] Theodore Peterson, *Magazines in the Twentieth Century* (Urbana, IL: University of Illinois Press, 1964), pp. 1–43.

magazines, epitomized by Curtis Publishing Co.'s *Saturday Evening Post, Ladies' Home Journal*, and *Country Gentleman*, cut subscription rates to attract a mass middle-class audience. With advertising-filled periodicals blanketing the nation, the heavily subsidized second-class mailings grew 20 times faster than the population in the four decades after 1880.[47]

Motion pictures also did much to shape a national community of tastes, style, and culture. Weekly attendance in the United States rose from an estimated 40 million in 1922 to 115 million 8 years later.[48] With this explosive growth, which cut across geographic and socioeconomic lines, came concerns about the effects of the new medium. While the censors watched for scenes that seemingly encouraged crime or sexual promiscuity, they missed a more subtle yet pervasive effect: film's power to nationalize tastes for cultural fare as well as consumer goods.[49]

Radio augmented the effects of magazines and motion pictures as agents of national culture. Although radio was originally envisioned as a local medium, local stations were soon taken over by national networks.[50] Within 10 years, 97 percent of all radio stations were affiliated with a network. Through the 1930s and 1940s, radio was the preeminent medium of mass impression, eclipsing newspapers, magazines and even film.

The role of the telephone was distinct, but by no means less important. The telephone empowered the individual. In contrast to the telegraph and mass media, it allowed people to formulate and receive messages, and to represent themselves, directly, without resort to any institutional intermediaries. With the telephone, any person could organize groups and canvass and lobby on behalf of a particular politician or social cause. Using telephones for such purposes was initially limited because of cost. Even at the turn of the century, telephones cost $200 a year, a sum that was well beyond the means of most workers, for example.[51]

Telephones also reinforced community ties, especially in rural areas. Whereas the telegraph and mass media technologies had directed local community attention outward, most telephone conversations were local in nature.[52] Between 1907 and 1927, for example, the average's person's local point-to-point communication—letters, telegraphy, and telephony—increased primarily because of growth in telephone use.[53] This reinforcement of social interaction at the local level played "a part in the preservation and even in the enhancement of local patterns of attitude, habit and behavior, and served as an inhibitor of the process of cultural leveling which is so often assumed as an outstanding and unopposed tendency of American life."[54]

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[47] Ibid.

[48] Malcolm Wiley and Stuart A. Rice, *Communication Agencies and Social Life* (New York, NY: McGraw Hill, 1935).

[49] Garth Jowett, *Film: The Democratic Art* (Boston, MA: Little Brown and Co., 1976), p. 202.

[50] A number of factors promoted the development of national networks, including agreements among key industry players; audience demand for expensive programming; a system of financing based on national advertising; and the incentive structure embedded in national regulatory decisions. See Christopher Sterling, "Television and Radio Broadcasting," in Benjamin Compaine (ed.), *Who Owns the Media? Concentration of Ownership in the Mass Communication Industry* (White Plains, NY: Knowledge Industry Publications, Inc., 1979).

[51] Ithiel de Sola Pool, *Forecasting the Telephone: A Retrospective Technology Assessment* (Norwood, NJ: Ablex Publishing Co, 1983), p. 82.

[52] Changes in William Allen White's *Emporia* (Kansas) *Gazette* during the 1920s, as a result of the telegraph, illustrate some of the consequences for rural areas. According to Griffity: "The net effect, then of the *Gazette's* increased advertising and greater access to syndicated materials was to diminish the very centrality of its community. Emporians could no longer gain the impression from reading their local newspaper that Emporia—or their own lives—mattered much in the scheme of things... [The community's citizens] may also have been aware of a concomitant waning of a sense of the legitimacy of their day-to-day lives. For, rather than focusing on local events, the paper dramatized far-away people and places. Instead of recording the life passage of their neighbors, it reported the abnormality of strangers." As cited in Richard Kielbowitz, "The Role of Communication in Building Communities and Markets," contractor report prepared for the Office of Technology Assessment, November 1987.

[53] In 1907, an average of 4.5 months elapsed between each toll telephone call but only 3 days between each local call. Wiley and Rice, op. cit., footnote 48.

[54] Ibid., pp. 153–154.

The value of telephony to rural communities and markets was reflected in penetration levels; some Midwestern states had more phones per capita than Eastern states. The benefits of the telephone were many; rural households used the phone to summon doctors, visit each other, obtain weather reports, learn about sales in towns, and follow prices for agricultural commodities in local or regional markets.[55] Not surprisingly, residents in rural areas heralded the telephone's potential to end their isolation. Impatient to receive service, a number of towns and cities launched their own systems, with farmers in some cases constructing crude systems using barbed wire attached to fence posts.

In integrating the nation, communication technologies served not only to break down barriers of geography, culture, and class. These technologies were used at the same time to circumvent traditional information gatekeepers and political intermediaries such as the press and political parties.

It was not long after telephones had been invented, for example, that politicians came to see them as being central to their activities. In 1878, Congress set up the first telephones in Washington to connect the Public Printer's Office with the Capitol so that members could order extra copies of their first speeches. With the deployment of telephones in more and more homes, they began to be used to canvass voters. By 1910, one commentator noted, "In a political campaign the telephone is indispensable."[56]

Politicians also used communication technology to establish a direct relationship with the public. Thus, President Roosevelt used his "fireside chats" to lift spirits during the depression and to rally Americans behind the war effort. Similarly, in 1948, the Republican, Democratic, and Progressive parties all held their conventions in Philadelphia to take advantage of the coaxial cable, which allowed them to broadcast the proceedings over four networks to 18 stations in nine cities.[57]

Whereas network television tended to focus a single message to a large number of viewers, the development of cable television enhanced viewers' choices, and allowed them to select programming that was more closely targeted to groups of specific viewers. The original goal of community antenna television (CATV) was to provide a practical way of enhancing television signals for communities on the fringe or outside of good broadcasting reception. Eventually, however, cable operators were able to expand their markets by importing broadcast signals, thus being able to offer many more programming channels as well as better service.

Communication technologies, it should be emphasized, were employed not only in the realm of politics. Towards the end of the 19th century, the government itself began to make greater use of these technologies for purposes of both national defense and public administration. In the First World War, for example, radio technology (radar) proved critical in controlling long-distance sea and air transportation. By 1922, radar technology was capable of detecting ships at sea and planes in flight, for which purpose it was deployed on all U.S. battleships during the Second World War.[58]

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[55] These latter two applications were among the few by which the telephone enhanced the competitive position of small producers and retailers. For discussion of the impact of telephony on rural communities, see Michael Olsen, "But It Won't Milk the Cows: Farmers in Colfax County Debate the Merits of the Telephone," *New Mexico Historical Review*, vol. 61, January 1986.

[56] Ithiel de Sola Pool, *Forecasting the Telephone: A Retrospective Technology Assessment* (Norwood, NJ: Ablex Publishing Co., 1983), p. 82.

[57] Ruben Frank, "1948 Live ...From Philadelphia...It's the National Conventions," *The New York Times Magazine*, April 17, 1988, pp. 37, 62–65.

[58] Beniger, op. cit., footnote 1, p. 414. Having witnessed the military benefits of radio technology first-hand during World War II, the U.S. Government intervened to help establish the Radio Corporation of America (RCA), which subsequently bought out the British-dominated American Marconi Company. In this way, the Government helped to solidify the U.S. position in international communication. See Daniel Czitrom, *Media and the American Mind (*Chapel Hill, NC: University of North Carolina Press, 1982), p. 86.

The Government also took advantage of computers and data processing technology to help provide public services and oversee an ever more complex and interdependent domestic economy (see table A-2). In 1930, for example, the Census Bureau used punch card tabulating machines for the first time, increasing average punching rates from 500 to 700 cards per day and daily tabulating rates from 10,000 to 80,000 persons per day.[59] Other agencies were quick to follow suit; tabulating machines were subsequently used, for example to centralize federal records on insurance, public health and vocational education, to monitor the economic depression, to maintain employment statistics, to control security exchanges and over-the-counter markets, as well as to process social security taxes and benefits payments.[60]

From this account of the ways in which communication technologies have affected the evolution of U.S. politics, four major impacts can be identified. First, communication technologies helped to integrate the nation by extending nationally oriented messages over broad geographic areas in a manner that bypassed traditional local, cultural, or socially based information gatekeepers. Second, communication technologies provided at the same time mechanisms for individuals and groups to access information, identify and organize like-minded people, and promote their ideas at all levels of government, thereby holding the government accountable and assuring the representation of their views. Third, communication technologies provided government the means to administer laws, maintain order, assure the national defense, and promote the general welfare in an increasingly complex and interdependent social and economic environment, which required dealing with events such as industrialization, the depression, and the Second World War. Finally, by supporting all of these functions on a relatively equal basis, communication technologies helped to maintain the balance—necessary to sustain democracy—between participation and control.

Looking at the role of communication technologies in American politics, however, it is clear that these technologies have been neither equivalent nor technologically neutral with respect to political outcomes. Although the telegraph and mass media fostered national integration, they served at the same time to diminish the interests of particularistic groups. On the other hand, the telephone facilitated political organization at all levels, while cable broadcasting increased the number of outlets available for competing political perspectives. With a range of technologies available, striking the appropriate balance between participation and control was more easily accomplished.

Channeling information to some gatekeepers while circumventing others, communication technologies also helped to determine the distribution and locus of political power. Over the course of American history, for example, the role of information gatekeeper was shifted from the local newspaper proprietor, to the legislative representative, to the political party leader, to the television news analyst, transforming American politics in the process.

Although communication technologies have strongly influenced American politics, these technologies were not autonomous in their effects. Fully aware of their political potential, the American Founding Fathers established a basic legal framework in the Constitution that has served to establish the general direction in which communication technologies have evolved. Within that framework, politicians, vendors, users and other stakeholders have all sought to ensure that technologies match their preferences. In interpreting the impact of technologies, the institutional context in which technology evolves must always be kept in mind.

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[59] Describing the impact of tabulating machines on government some 80 years later, the National Commission of Federal Paper Work estimated that "Federal agencies are today churning out forms, reports, and assorted paper work at the rate of over 10 billion sheets per year. That's 4.5 million cubic feet of paper," As cited in Beniger, op. cit., footnote 1, p. 420.

[60] Ibid., p. 420.

TABLE A-2: Selected Innovations in Information Processing and Communication, 1830–87

Year	Innovation
1830s	Wagon lines carrying freight between rural towns and ports begin to operate on regular schedules
1837	Telegraph demonstrated, patented
1839	Express delivery service between New York and Boston organized using railroad and steamboat
1840s	Freight forwarders operate large fleets on canals, offer regular through-freight arrangements with other lines
1842	Railroad (Western) defines organizational structure for control
1844	Congress appropriates funds for telegraph linking Washington and Baltimore; messages transmitted
1847	Telegraph used commercially
1851	Telegraph used by railroad (Erie) First-class mail rates reduced 40-50 percent
1852	Post Office makes widespread use of postage stamps
1853	Trunk-line railroad (Erie) institutes a hierarchical system of information gathering processing and telegraphic communication to centralize control in the superintendent's office
1855	Registered mail authorized, system put into operation
1858	Transatlantic telegraph cable links America and Europe, service terminates after 2 weeks
1862	Federal Government issues paper money, makes it legal tender
1863	Free home delivery of mail established in 49 largest cities
1864	Railroad postal service begins using special mail car Postal money order system established to insure transfer of funds
1866	Telegraph service resumes between America and Europe "Big Three" telegraph companies merge in single nationwide multiunit company (Western Union), first in United States
1867	Railroad cars standardized Automatic electric block signal system introduced in railroads
1874	Interlocking signal and switching machine, controlled from a central location, installed by railroad (New York Central)
1876	Telephone demonstrated, patented
1878	Commercial telephone switchboards and exchanges established, public directories issued
1881	Refrigerated railroad car introduced to deliver Chicago-dressed meat to Eastern butchers
1883	Uniform standard time adopted by United States on initiation of American Railway Association
1884	Long-distance telephone service begins
1885	Post Office establishes special delivery service
1886	Railroad track gauges standardized
1887	Interstate Commerce Act sets up uniform accounting procedures for railroads, imposes control by Interstate Commerce Commission

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Appendix B: U.S. Public/Private Aid Related Telecom Programs B

Executive Summary from the publication: "U.S. Government, Private Sector, Non-Profit, and Academic Contributions to Communications Development," Information Infrastructure Task Force, March, 1994.

The United States has a long tradition of supporting international communications development as a means for sustained economic growth and improvement of health, environment, and welfare. Our support for communications development comes form a variety of sources—the U.S. Government, the private sector, non-profit organizations and academic institutions. The U.S. Government has committed substantial financial resources to international communications development in the form of export credits and guarantees, loans and investment guaranties, grants, training services and feasibility studies. The U.S. private sector has contributed new technology, financial and other resources for training programs and technical assistance, as well as substantial product and service expertise. In addition, U.S. non-profit and academic institutions have lent support to international communications development needs through training and exchange programs, grants, fellowships and relief services.

U.S. GOVERNMENT ASSISTANCE

A wide range of U.S. Government agencies, from the Department of Commerce to the Federal Aviation Administration in the Department of Transportation, contribute to international communications development. Highlights of these contributions include the activities of the U.S. Agency for International Development, which in 1993 expended almost $34 million on telecommunications training, technical assistance, and infrastructure. In addition, between 1991 and 1993, the Export-Import Bank's loans and guarantees in the telecommunications sector totaled $1,854,976,535 excluding insurance authorizations, which totaled approximately $400 million. In Fiscal Years 1988 through 1993, the Overseas Private Investment Corporation provided $434,030,732 in political risk insurance and $195,650,000 in financing through direct loans and/or loan guarantees to developing countries. Another important contributor is the U.S. Trade and Development Agency, which committed $8 million of its budget toward communications development projects for 1994.

There also are a number of U.S. Government agencies which provide assistance to developing countries, not only through financial resources, but through critical training, studies, and other

services. For example, the National Telecommunications and Information Administration (NTIA), an agency within the U.S. Department of Commerce, under the Protocol on Cooperation in the Field of Telecommunications Science and Technology between the United States and the People's Republic of China (PRC) has engaged with China in cooperative studies and other activities in radio frequency spectrum management and disaster communications. Technical exchanges were the primary activities under the Protocol in 1993 and 1994, such as an exchange with spectrum management officials from the Chinese Ministry of Posts and Telecommunications in March 1994. NTIA is expected to lead a delegation of experts in disaster communications to the PRC in late 1994 or 1995. In addition, the Federal Communications Commission, the U.S. Government agency which regulates communications activities in the United States provides specialized training and technical assistance bilaterally, as well as through the International Telecommunication Union and the United States Telecommunication Training Institute (USTTI). This year, the FCC will conduct courses on Spectrum Management in the Civil Sector, Radio Spectrum Monitoring and Measuring, and Radio Spectrum Monitoring Techniques and Procedures for USTTI.

One of the U.S. Department of State's objectives is to promote expansion of the economic and social benefits of the communications and information revolution to developing countries. Through the Bureau for International Communications and Information Policy (CIP), numerous organizations have received grant funds for development activities, totaling about $250,000 per year. Organizations which have been recent recipients of such funds include the International Telecommunication Union, the Inter-American Telecommunications Conference (CITEL), the Black College Satellite Network, the Trans-Atlantic Dialogue on European Broadcasting, the Organization for Economic Cooperation and Development, and the United States Telecommunications Training Institute. CIP also administers programs for telecommunications development assistance to countries in Central and Eastern Europe (CEE) and the Newly Independent States (NIS) of the former Soviet Union under Interagency Agreements with the U.S. Agency for International Development (USAID). The CEE program has been funded at about $3 million over four years, and the NIS program is funded in the current fiscal year at $365,000.

The National Science Foundation (NSF) is another U.S. government agency affecting international telecommunications development. With private sector assistance, NSF has vastly enhanced the global connectivity of information networks, including implementing or expanding links to networks in Europe, Latin America, Pacific Asia, and Russia and other Newly Independent States. NSF also provides support to U.S. scientists and engineers to enable them to collaborate with colleagues in other countries around the world. The United States Information Agency (USIA) also contributes substantial resources in the area of communications development. It spends more than $100 million annually on communications development activities providing overseas information, education, and cultural affairs programs, including the Voice of America, the WORLDNET satellite television network and educational and cultural exchanges.

U.S. PRIVATE SECTOR

U.S. private sector activities include contributions of companies such as the Communications Satellite Corporation (COMSAT), MCI, Motorola, NYNEX, Southwestern Bell, and from organizations representing groups of companies, such as the Telecommunications Industry Association. Contributions of these entities frequently involve conducting training courses and participation in conferences. For example, COMSAT funds a major part of INTELSAT's $500,000 annual International Assistance and Development Program and has trained over 190 United States Telecommunications Training Institute participants at its corporate facilities in the United States. In addition, Motorola's Government Relations Office, which is divided into regions

and has offices around the world, has offered seminars to developing countries on effective spectrum management practices. The Telecommunications Industry Association, with a number of U.S. companies, for the past four years has cosponsored the Southeast Asia Telecommunications Conference, as well as the first Latin American Telecommunications Summit. Both of these conferences provided an opportunity for Ministerial level officials from the regions to meet with senior representatives from U.S. companies and U.S. Government officials.

U.S. NON-PROFIT ORGANIZATION ASSISTANCE

U.S. non-profit organizations also have made substantial contributions to international communications development. For example, both the public and private sectors in the United States support the United States Telecommunications Training Institute (USTTI). USTTI is a non-profit, joint industry-government initiative that encourages communications and technological advances on a global basis by providing free training courses for qualified men and women from developing countries. Over 3,000 officials from 136 countries have attended USTTI courses—with over 800 of these being supported by U.S. Agency for International Development funding. In 1993, the USTTI's sponsors contributed a total of $4,829,647 in cash and in-kind contributions to the USTTI.

Another example of U.S. non-profit organization assistance is the work of the Volunteers in Technical Assistance (VITA). VITA's 5,000 volunteers, located in over 100 countries, have responded to more than 200,000 requests form around the world for technical information about a variety of developmental issues. VITA has published more than 200 manuals and technical papers on specific technologies and developmental issues and publishes an electronic newsletter on international development, DevelopNet News, which is distributed through BITNET and Internet. In addition, over the past decade, VITA has implemented more than $50 million in major projects that have built VITA's capacity to ensure effective and cost-efficient project implementation. Furthermore, VITA has been granted an experimental license to operate a data-only low earth orbit satellite system, a little LEO system.

U.S. ACADEMIC PROGRAM ASSISTANCE

Academic organizations such as the American Society for Newspaper Editors (ASNE) also have made substantial contributions to communications development. ASNE, an organization of approximately 900 newspaper editors in the United States, sponsors an International Exchange Program to bring journalists from around the world to the United States for six weeks of study and work. In 1993, the Exchange Program exclusively solicited applicants from the editors' ranks in developing countries, including the new democracies of Central and Eastern Europe, and other countries in transition. Another academic program, the World Press Freedom Committee, a non-profit, U.S.-based private coordination group of U.S. and international media organizations, has made 150 grants, totaling approximately $1 million, since 1977 to aid news media and journalism schools in the developing world, Central and Western Europe, and the former Soviet Union.

Appendix C: Participants for Workshop One—October 18, 1994

C

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