

TIPI International White Paper

**Emerging Issues in the International Telecommunications and Information
Environment: Research Topics**

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INTRODUCTION

In much of the discourse over the last few years, the following series of conjectures and statements have been given the status of "truths" by commentators who seek to examine and describe the wholesale changes brought about in the global socioeconomic system as a result of the advent of the information society:

- That economic growth is directly linked to levels of telecommunications and digital infrastructure.
- That the intangibility of the information resource levels the playing field for corporations, governments, and communities around the world.
- That a "new economy" has emerged that in fundamental ways supplants what went before; in this economy, information means money.
- That information flows have "opened" otherwise closed or insular countries and that this opening has furthered prospects of democracy in these polities.
- That developing countries must get on the path to an information society or they soon will fall by the wayside.
- That governments should recede from regulating industries, including telecommunications, in favor of private sector or "market" forces.

Still, despite the prevalent discourse, there are critical views of each of these notions. Scholars and critics who seek to unpack the dense rhetoric of "globalization" point towards increasing disparities in power between countries, in wealth within and among countries, and, further, they adduce evidence to suggest that while capital flows freely in the increasingly globalized world, people do not--thereby creating conditions whereby certain countries and certain "global cities" continue to accrue economic benefit, often at the distress of "disconnected" countries and hinterland areas within both developed and developing countries. Moreover, critics point out that globalization need not necessarily imply privatization of once public resources, although the nation-state, once considered the integral unit of analysis in political economy, no longer reigns sovereign. Trade agreements and supranational organizations like the World Trade Organization have increased importance and often supersede individual states' policy making bodies. Trade blocks and regional cooperation agreements (i.e. NAFTA, Mercosur) have also been ceded power by nation-states.

Critical to the ability of capital and information to flow, often without regard to physical or national boundaries, is the existence of high-speed telecommunications linkages connected to a variety of types of hardware, which constitute the digital infrastructure. This infrastructure along with customized software enables the almost instantaneous

transfer of money and information--the very process of transfer and transmission constitutes an inordinately large percentage of the "economy."

At TIPI International, our goal is to understand the ways in which telecommunications and information intersect processes that are governing economic and social systems in the world. What types of policy frameworks would allow for continued economic expansion while ensuring equity and access? How should institutions be configured and how should they interact to ensure constant innovation, but without concomitant social ills being created? Should all countries be subject to the oft-prescribed remedies of privatization and competition or should the importance of local factors supersede the "needs" of global capital? How can companies, governments, and communities close the digital divide? Is technological harmonization sufficient, or need policy harmonization as well?

The questions asked above are simply points of departure. What theories are implied in these questions? What is the evidence to support views from different sides? TIPI International's project is to gather the crucial sets of evidence in order to begin answering such questions and to create analytical frameworks that would help companies, governments, and communities in their ability to understand the implications of the telecommunications, information, and Internet "revolution."

We have identified the following areas that will form the core of our analytic efforts:

- Telecommunications
- Innovation Clusters/Technopoles
- Electronic Commerce

We recognize that these three areas are not distinct or mutually exclusive. We plan to use this first White Paper to establish the scope of a broad research agenda in these areas.

A series of workshops, conferences, and presentations on areas covered in this white paper will be convened over the coming years. We also are ready to undertake research projects on issues connected to telecommunications, information, and innovation policy; with our web of professors, student associates, and outside contacts, we plan to create balanced, well-researched, and informative reports for scholars, businesses, and policymakers.

The following is a set of *research questions* that the work behind this White Paper suggests. They identify some of the most significant problems researchers should tackle in the near term.

1. How do supra-national and national institutions work together to manage change in the global information economy? How are their interests similar or different? What types of internal institutional reconfigurations are necessary for nations to compete in the global information economy?

2. What is the role of the State in creating conditions conducive for information enterprises and to innovation in general? How has the State itself changed due to the demands of supra-national institutions and of the competitive marketplace? How must the state deal with corporations in order to ensure the prerequisites for economic growth?
3. What are the social impacts of deregulation, privatization and liberalization? What interests are served by these purposes and what interests are neglected? What effects on organized and unorganized labor are engendered by the changes in the global economy?
4. What is the role of "place" in the information economy? Does location matter? And if so, how? What are the economic implications of being proximate to technological innovators and to large sources of demand for technological products? Is the "global village" a reality or just empty rhetoric?
5. How are telecommunications and innovation correlated with the general well-being of societies? Is there a causal link between expenditure on telecommunications and technology in general and the standard of living of a nation's people? What might be the economic and social outcomes of similar expenditure in other sectors, for instance, healthcare?
6. What type of ordering principles characterizes societies that are technologically advanced?
7. How are social provisions like Universal Service guaranteed in a privatized telecom environment? What provisions for Universal Service will be made by countries whose telephone density is extremely low?
8. Will e-commerce fundamentally disrupt traditional business activity and traditional consumer patterns? Or is it just a variation on the same basic theme? How will international trade be affected by e-commerce?
9. What kind of institutions and institutional frameworks are required for a successful deployment of e-commerce functions? How can the traditional legal and policy institutions regarding privacy and intellectual property change their modus operandi to meet the demands of an e-commerce marketplace?
10. What outcomes are associated with the quickly privatizing, liberalizing, and deregulated global economy in terms of increasing disparities among countries, communities, and social groups around the world? What are the wealth-concentration trends in this economy?

1. TELECOMMUNICATIONS

As countries throughout the world attempt to become economically competitive, they are increasingly emphasizing the role of telecommunications facilities and networks in enhancing economic growth. The correlation between advanced telecommunications facilities and economic growth has become a truism. A number of studies have demonstrated the positive relationship between telecommunications development and economic growth. (for a detailed research overview in this area, see Saunders et al., 1994). Even though many scholars are careful to avoid claiming causality, the abundant evidence on the association between telecommunications and economic performance gives enough justifications for policy makers to prioritize telecommunications development over other social and economic needs.

As evidence mounts that the state-owned telecommunications behemoths are inefficient and technologically obsolete, countries are being prodded to liberalize and/or privatize their telecommunications networks. Given the enormous size of the telecommunications industry, these events are of extremely important proportions in any study of the global economy. The mix of liberalization/privatization and the international flow of capital has transformed the scenario in the telecommunication sector, whereby this sector, once considered a utility only, has now been cast as a major profit center. Samarajiva and Goddard comment that "what were once plain old voice networks are now seen as the central conduits of the information society, analogous to the canals and railways of the industrial society" (1990, p. 227).

Thus, we recognize the *duality* of telecommunications:

- Telecommunications services and networks are factors of production for other industrial sectors.
- The telecommunications industry is, increasingly, a major economic sector in and of itself.

Within the orbit of telecommunications are several parameters, each of which can be treated as an area of inquiry and research. The following is a roadmap of this section:

Parts A, B, C, and D deal with broad policy aspects of international telecommunications. Parts E and F deal with political parameters that affect the international political economy of telecommunications. Part G, H, I, J, and K deal with specific aspects of the quickly changing international telecommunications milieu.

A. Policy Aspects

As supra-national organizations increasingly determine national economic and social outcomes, any understanding of the global telecommunications and information environment must take into account the ways in which various organizations, both supra-

national and national, interplay with each other in shaping the global policy environment. Chief among these organizations are the World Trade Organization (WTO), the International Telecommunication Union (ITU), the International Monetary Fund (IMF), the US Federal Communications Commission (FCC), and the European Union (EU).

Though the WTO is not focused on telecommunications issues only, the trade regime promulgated by the WTO necessarily includes large, important industries like telecommunications.

World Trade Organization

Trade in telecommunications services had been almost nonexistent until quite recently because telecommunications carriers in most countries were domestically owned, often by the national governments themselves. Beginning in the mid-1980s, however, countries gradually started to incorporate telecommunications services into international trade regimes, under the auspices of the General Agreement on Tariffs and Trade (GATT) and, later, the World Trade Organization (WTO). Today the WTO has become the primary policy body for the economic, and often political, aspects of international telecommunications.

The WTO is important for the following reasons:

- It has great importance in overall global trade climate.
- It impinges on the relationship between trade rules and communications laws/obligations.
- Its protocols are directly connected to creating particular investment climates in different countries.
- Its protocols directly affect the ability/inability of the market to furnish equity.

Particularly important in the WTO's recent activities is the agreement reached by 69 member nations in 1997 on the liberalization of basic telecommunications services. The direct precedent to the 1997 agreement was the Telecommunications Annex created during the GATT's Uruguay Round negotiations (1986-1994). Although the Telecommunications Annex lacked the clarity that would help to enforce rules, it was a crucial first step toward creating the globalized telecommunications carriers and services with which we are so familiar today. The 1997 pact essentially removed foreign investment barriers to signatories' domestic telecommunications markets (accountable for more than 90 percent of the world's telecommunications revenues). Just like other trade-related rules and agreements in the WTO, the pact on basic telecommunications services would significantly affect national sovereignty because it requires signatories to amend their respective domestic laws and rules in accordance with WTO rules.

Areas of inquiry:

- What is the balance between national sovereignty and free trade?

- What are the issues surrounding foreign ownership of telecommunications operators?
- What type of regulatory coordination exists between domestic and international policy makers?
- To what degree and with what effect do the WTO's protocols pre-empt domestic laws.
- How does the WTO affect the relationship between incumbent PTTs/privatized monopoly and new market entrants (both domestic and international)?
- What are the immediate and long-term impacts on developing countries of their obeisance to WTO protocols.
- Does the WTO supersede economic unions and trade blocks, such as NAFTA and Mercosur

International Telecommunication Union

The International Telecommunication Union, one of the oldest international organizations, plays a fundamental role in global and national telecommunications policy. The Union was founded in 1865 when nations realized the need for international coordination of radio telegraphy in order to avoid frequency interference. In the next century and half, the Union has been the primary international arena where nations and telecommunications carriers convened and coordinated for the smooth international operation of telephone, radio, and satellite communications.

Members of the ITU include corporations and governments. The respective goals of these actors are often different.

The ITU performs three main functions (which correspond to the sectional divisions of the ITU),

1. Radio Communication: international radio frequency allocation/allotment, satellite orbital slot allocation/allotment, dispute settlement, interference management, etc.
2. Standardization: harmonizing telecommunications standards among the nations.
3. Development: overall development of telecommunications technologies and services globally.

(Frieden, 1996, p. 65)

The ITU's member nations have historically maintained cooperative attitudes in order to maximize the benefits of interference-free radio operations. At times, however, the ITU has come under various pressures as more diverse interests began to emerge and compete for worldly communications resources. The sheer increase in the number of the Union members (188 governmental members and 600 non-governmental members including private companies as of 1999) poses a challenge to establishing multilateral, world-wide based agreements and coordination. More importantly, however, the Union, which traditionally had been a technical and administrative organization, increasingly has become a political arena in which national, private, and public interests directly confront each other. For example, starting in the 1970s orbital slot allocation has become an area in which the incumbent users (i.e., developed nations) have been challenged by

developing countries that demanded a fair share of the finite space resource (orbital slots). Related to this are the problems of non-coordinated satellite launching (e.g., China's unilateral launching of a satellite in 1994 into a slot where potential frequency interference with adjacent satellites is very strong) and the "paper system" (e.g., the Kingdom of Tonga's registration for an orbital slot with the sole purpose of leasing the slot to other countries/carriers for profit) (Kennedy and Pastor, 1996, p. 57).

In addition, the Union has come under the pressure of liberalization and privatization movements across the world and must adjust its regulatory activities to the deregulated telecommunications environment.

The ITU has recently launched a reform effort in order to adjust the Union to the changing contours of international telecommunications (The Plenipotentiary Conference, Minneapolis, 1998). Although the specific changes have not been finalized, the nature and the direction of the ITU reform were clearly indicated in recommendations from the ITU Reform Advisory Panel (ITU, 2000). Some notable recommendations include:

- Public/private sector partnership: the desirability of a greater participation by the private sector in the decision-making processes in the Union. The recommendation states that the public-private partnership at the Union should resemble the existing telecommunications environment in which "the private sector plays the lead role while the regulatory agencies act as an arbitrator."
- Development: the need for a greater involvement by the ITU in narrowing the digital divide between the developed and the developing worlds. The recommendation suggests that the ITU should provide assistance to developing countries and help them adopt pro-market regulatory frameworks.
- Co-operation: the Union should harmonize its activities with other international bodies such as the WTO and the World Bank.

Areas of inquiry:

- How will the global telecommunications environment develop in the face of heterogeneous interests? Will the ITU buckle to pressures from other international organizations (e.g., WTO and OECD) that may not share the traditional organizational scopes of the Union?
- How will the North-South and East-West division in terms of radio and satellite orbital slots allotment ultimately be resolved?
- What standard setting processes will emerge in the face of greater competition among competing carriers and manufacturers?
- What dispute settlement mechanisms will emerge? To what degree will supra-national regulatory bodies supersede national policies and bilateral agreements? What effect on trade will be established as the WTO enshrines the principle of cross-retaliation if agreements are not abided to?
- How will the ITU harmonize policy activities with other international institutions?
- How will the blending of corporate and state interests work itself out in the international telecommunications environment? How will such a blending affect

issues like dispute settlement mechanisms and the need for social provisions in telecommunications policy?

Federal Communications Commission

The FCC is the United States' national regulatory body. It plays an important role in U.S. telecommunications and information policy and, as such, it plays an incredibly important role in determining the policies that other countries adopt as well. In recent years, the FCC has been actively harmonizing its international policy with that of the World Trade Organization, especially with the WTO's historic agreement on the liberalization of basic telecommunications (1997).

On the other hand, however, the FCC has acted unilaterally on certain policy areas before gaining international consensus. A case in point is the FCC's effort to establish fixed international accounting rates for international calls involving U.S. carriers (Kennedy and Pastor, 1996, pp. 123-130). Such a practice would affect not only the rate structure for U.S. international carriers but also foreign carriers' revenue streams--often built upon profitable international toll revenues--to furnish universal service or other social obligations.

Beyond its role as a U.S. negotiator at international bodies such as the ITU, the FCC also performs various functions which have international repercussions. As recently as 1999, the FCC initiated an assistance program--Connecting the Globe--aimed at a few key developing countries in Africa, Asia, Latin America/Caribbean, and central Europe (Federal Communications Commissions, 1999). Under this program, the FCC provides regulatory and policy assistance to developing countries to enhance a transition to pro-competitive telecommunications markets.

Areas of inquiry:

- What is the role of the FCC in the international regulatory community?
- What are the motivations behind the FCC's effort to render policy assistance to other countries? How does the FCC coordinate international assistance and other international activities?
- How are other countries responding to the FCC's unilateral or negotiated measures?

Special focus: Harmonization

As policy organizations and trade agreements increasingly emphasize the need for open door policies for capital and investment, the issue of standards or "harmonization" has come to the fore. This connotes both technological standardization and policy harmonization that allows for seamless national policies on telecommunications, information, and e-commerce.

As in the case with regional bodies such as the European Union, harmonization is key if economic unity is to be sought after.

Harmonization has become the watchword in an increasingly integrated global telecommunications and economic environment, especially with regard to EU directives in this area. Harmonization refers essentially to the need for standards in the following areas.

1. Technologies: How will countries and companies with different technology standards work together to create a seamless web of telecommunications services?
2. Policies related to telecommunications and information: How will differing national policies be collapsed into one global policy to create the seamlessness necessary for efficient telecommunications?
3. General economic and investment policies: How will countries with wholly different policies vis-à-vis trade and investment cope with the policy homogeneity necessary for the efficient operation of telecommunications providers?
4. Statistical measurement of various telecommunications indicators: Countries and companies need to employ the same metrics so that comparisons and differences are understood in common terminology.

B. Access and Equity

Uneven telecommunications developments among different countries have been a persistent feature of the global telecommunications map, but such a recognition has been heightened since the mid-1980s when the Maitland Commission reported striking statistics, including a telling story that there were more telephones in Tokyo than in the entire continent of Africa (ITU [Maitland Commission], 1984). The problem was revisited more recently when the Administrative Committee on Coordination of the United Nations issued "The Statement on Universal Access to Basic Communication and Information Services:

"We are profoundly concerned at the deepening maldistribution of access, resources, and opportunities in the information and communications field."

(United Nations, 1997, paragraph 5)

As countries throughout the world are reconfiguring their telecommunications industries, the issue of Universal Service/Access is itself being reconfigured and recast; still, it is uniformly on the agendas of all telecommunications policy bodies.

There has been considerable debate about the general definitions of key terms in the areas of access and equity. The most important subject of inquiry here is Universal Service. The definition of this term as propounded by the WTO is rather vague and allows great

latitude country to country (though many countries have on their own defined the term in more precise, exacting ways).

Universal Service: Any Member has the right to define the kind of universal service obligation it wishes to maintain. Such obligations will not be regarded as anti-competitive *per se*, provided they are administered in a transparent non-discriminatory and competitively neutral manner and are not more burdensome than necessary for the kind of universal service defined by the Member. (Inter-American Telecommunications Commission, 2000, p.11)

Shorn of political motivation, this term can be reduced to one sentence--referring, simply, to the obligation to provide telecommunications service to all residents of a country irrespective of their demographic or geographical location.

As telecommunications access disparities between developed and developing countries and within countries as well are being exacerbated, this issue is a fundamental social aspect of any understanding of the global telecommunications environment. From a sociological perspective, Gillespie and Robins (1989) argue that the geographical inequalities in telecommunications development (i.e., developed vs. developing countries, and rural vs. urban areas) would lead to a spatial hierarchy with strong centralizing and monopolizing tendencies by the technologically advantaged regions.

Not only with regard to social obligations, universal service also presents long-term business opportunities to companies that would win markets heretofore untapped. Since competition for these areas is by definition low, a niche player could come in and stand to make substantial profit. This is true given the fact that even in the most developed countries, there is not universal access/service.

Table 1. Teledensity in selected countries

Country	Teledensity in 1999
Chad	0.12
Mali	0.25
India	2.20
Thailand	8.35
China	8.59
Mexico	11.22
Brazil	14.87
Lebanon	19.43
Turkey	26.47
Japan	49.40
Singapore	57.70
Germany	58.78
United States	66.10
Switzerland	69.87
Norway	71.20

Note: Teledensity measures the number of main telephone lines per 100 inhabitants.

Source: International Telecommunication Union, 1999.

Universal Access

We recognize the following five elements as essential for achieving universal access/service:

1. Affordability: Affordability of services to everyone within national, regional, and local contexts.
2. Availability: Physical availability of necessary infrastructure, network components, and supporting mechanisms.
3. Accessibility: Uniform and undifferentiated quality and quantity of services across geographies (i.e., urban and rural) and user segments (i.e., business and residential).
4. Applicability: The existence of different communities with different histories and wholly different economic and cultural frameworks necessarily endangers differential ability to master the "cultural" components of telecom technologies.
5. Desirability: New research indicates that not all communities observe any benefit as a result of being wired; in short, having telecommunications access does not particularly ameliorate their general economic or social conditions.

These elements of universal access should be discussed separately for domestic and international contexts--though universal service funds have historically been derived from revenues from international phone traffic (for some countries) and from business-service subsidy (in the case of the United States). Although it is important to make policy and regulatory efforts to level the uneven telecommunications access across nations, we should be aware that the presence of severe inequalities within individual nations significantly reduces the effectiveness of such efforts. For example, Thailand's urban areas enjoy a moderate teledensity of 27.3 percent, while the teledensity for the country's rural areas, which account for 81 percent of the population, is a meager 2.6 percent (ITU, 1998).

Areas of inquiry:

- Regulators in many countries now encourage cost-based pricing for telecommunications services. How can this practice coexist with the universal service policy, which fundamentally disregards cost-based pricing?
- How should universal service funds be established? In the U.S. experience, carriers are obligated to contribute to the universal service funds, but by doing so, they pass the obligation on to the rate payers. Therefore, the hidden effect is the transfer of wealth from the privileged users (those who can afford regular price and live in urban areas where service provision is relatively cheap) to the unprivileged users (the poor and rural residents). Is it a more desirable scheme if the US funds are collected from carriers only? What are some of the creative and just alternatives available to ensure adherence to universal service obligations?
- Can technological solutions (the use of non-traditional transmission technologies to provide universal service) to universal service substitute regulatory solutions (US funds, regulatory obligations to traditional land-based carriers)?

Digital Divide

If the lack of universal service is a policy problem, the digital divide is a social problem that emerges from the intersection between social systems and communication technologies.

The digital divide is increasingly being addressed by scholars and policy makers who have seen that, with regard to the diffusion of technology, a rising tide does not lift all boats. This phrase refers to the international and intranational disparities not only in access to hardware and software but also in the cultural and educational prerequisites for using technologies like telephones, computers, and the Internet. Increasingly, companies and governments are looking at ways of making hardware available to impoverished sections of society but are finding that mere access is not a sufficient condition for the proper diffusion of technology-utilization.

There is a huge imbalance between penetration in advanced and developing countries (see ITU, 1998). In addition, there are huge rural-urban, gender, class, educational and cultural divisions.

The digital divide issue is not reducible to the lack of universal service. The idea of universal service refers to the access to physical infrastructures such as telephones and computers. In contrast, the concept of digital divide addresses underlying socio-economic inequalities that are manifested in information gaps.

Digital divide is nothing new in the context of international relations. The New World Information and Communication Order propounded (NWICO) by non-Western countries in the 1960s and 1970s precisely captured the notion that information inequality is a flip side of political-economic inequalities among countries. During this international debate, the question of "representation" emerged as the key issue. Whose interests are represented in the international flow of communication? Who is allowed to participate in decision-making processes over the terms and conditions of the international economy? The NWICO movement lost much of its momentum in the 1980s as more countries chose to adopt a free-market model for both general economic governance and telecommunications policy. Yet, the fundamental problem of information gaps persists today.

Areas of inquiry:

- How should we address the question of underlying inequalities (gender, income, class, education, geography, etc.) that largely determines digital divide? Are there viable means to resolve the problem of the digital divide within the existing socio-economic system?
- Do public authorities (both domestic and supra-national) have the capacity and the means to encourage private carriers to close the divide? Is the increasingly popular cost-based pricing compatible with the subsidized connectivity? What other regulatory schemes might be helpful?

- Which international institutions or fora are best suited to work on the problem of digital divide? Do we need to create a new institution to carry out this task?
- How should digital divide policy incorporate the notion of "not wanting" information access among some of unconnected people? Should government policies "force" people to become digital citizens?

C. Subsidies

The linchpin of universal service in many countries has traditionally been the subsidy. There are two major forms of subsidies in the telecommunications business.

First, subsidies (both direct and indirect) are funds that telecommunications users or carriers receive from other carriers or the government. The sources for the funds vary among countries. In the United States, for example, the "Lifeline" is a program, funded by telephone companies, that subsidizes part of the telephone bill for low-income residents. By contrast, in South Korea, the government took a strong initiative and passed various laws in the 1980s in order to raise universal service funds from government bonds and other public sources.

Second, subsidies occur internally within a telecommunications carrier. This form of subsidy--internal cross-subsidization-- takes place between the revenues from different lines of businesses (e.g., local service, long-distance service, enhanced services, etc.). However, two competing dimensions are observable in internal cross-subsidization. On the one hand, internal cross-subsidization has been a normal practice in many countries as a means to provide universal service. The government or the regulated private monopoly sets artificially high rates for some services (notably long-distance for businesses or international services) above actual cost in order to use the revenues from these services to set local service rates below cost. Thus, this type of internal subsidization reflects a public policy concern.

The second type of internal cross-subsidization has a private character reflecting the profit motives of private carriers. Telecommunications carriers often engage in both competitive and less competitive services. Provisioning less competitive services may promise guaranteed sources of revenues for carriers, while competitive services are, by nature, less reliable sources of revenue and profit. In order to increase the market shares in competitive services, carriers are interested in reducing the price in competitive services by using the revenue subsidizing from less competitive services. It is regulators' job to restrict this type of internal cross-subsidization in order to ensure a reasonable and well functioning competitive market place.

Areas of inquiry:

- Subsidization is the linchpin of universal service, but who should be subsidized by whom? Disadvantaged rate payers by privileged ratepayers? Disadvantaged rate payers by telecommunications companies? By the government?

- What is the changing meaning of internal-cross subsidization in the face of greater competition in traditionally non-competitive services? How will the lowered rates for long-distance and international services affect local service pricing?
- How should internal cross-subsidization be regulated? Are structural restrictions (e.g., divesting a carrier according to lines of businesses) necessary? How are different countries are addressing this issue?

D. Regulatory Frameworks

It is a truism that the booming telecommunications sector throughout the world is fueled by technological advancement. However, we must be reminded that the changing regulatory practices provide both the impetus and the method for much of the telecom restructuring in the past few decades. (For a brief overview of the importance of regulation, see Sinha, 1995.)

Just like the technological convergence toward digital technologies, we are observing a regulatory convergence toward telecommunications deregulation throughout the world. Some of the specific components of deregulatory policies are the corporatization, privatization, and liberalization. It is imperative to understand the contending interests played out in deregulatory phases, as well as the sequencing of different deregulatory phases and their effect on the post-deregulation environment.

There are two general frameworks:

- Deregulation-- deregulation refers to lessening the grip of the State on the functioning of the telecommunications sector. Implicit in this is the disarticulation of the regulatory function from the political process.
- Re-regulation--re-regulation refers to the separation of operations from regulation.

Specific Phases:

- Corporatization--in this phase, telecommunications carriers remain government owned, but separated from the regulator.
- Privatization-- privatization refers to the sale of former state-owned enterprises. The size and the speed of privatization greatly varies among different countries.
- Liberalization--liberalization refers to the removal of entry barriers to a previously monopoly market. However, liberalization is only a necessary condition for competition since non-structural barriers such as the lack of sufficient market size and brand loyalty discourage potential entrants. The presence of giant incumbents also impedes competition. We can identify at least four different pictures of a liberalized market:
 1. New entrants compete with the incumbent, state-owned monopoly (India)
 2. New entrants compete with the private incumbent (e.g., U.S.)
 3. New entrants compete against divested (smaller) incumbents (e.g., Brazil)
 4. Very few new players enter the market (many countries in Africa)

Areas of inquiry:

- How do we define liberalization and privatization? How much competition constitutes a "liberalized market"? How much of the state-owned enterprise must be privatized to take advantage of a privatized telecommunications environment? What do the processes of privatization and liberalization tend to achieve in the economic and social spheres?
- What is the optimal sequence of, for example, the creation of an independent regulatory agency, liberalization, and privatization? Is there such a thing as the optimal sequence?
- Many countries have introduced competition before privatization or the divestiture of the government-owned former monopoly. How is competition affected by the presence of a powerful incumbent in the market?

E. General Political Milieu

According to Cowhey (1990), a given telecommunications regime (e.g., PTT system, regulated competition, open marketplace, etc.) cannot be explained just by technological characteristics but also by the ways in which various political variables are consciously calibrated.

The wholesale changes in the global economic environment necessarily beg the question of national politics and the ability of national governments to implement policy directives that come from supra-national organizations. Different social and economic groups view the changes in the global polity in different ways and this causes ruptures and tensions in the socio-economic system and different countries have different internal issues to contend with. For example, in India large businesses were clamoring for rate reform and the entrance of competition in the Indian telecommunications market, but public sector employees and large tracts of the bureaucracy were totally against the entrance of competition.

Extremely important is the degree to which government decision making/policymaking and regulation are insulated from "lobbies" and "special interests." William Melody defines regulatory independence as the "independence to implement policy without undue interference from politicians or industry lobbyists"(1997, p.197). Authoritarian governments give the "okay" to privatization proposals more easily than do democratic polities (Mody and Tzui, 1995; Petrazzini, 1995), but issues of justice and social equity shift the terrain of analysis to understanding how decisions regarding telecommunications carriers can be made to both ensure social equity and create efficiency and innovation.

The existence and strength of trade/labor unions is an extremely important factor that impinges on any analysis of the relationship between political factors and telecommunications economics. In several cases of privatization and liberalization (for example, New Zealand, India) trade unions played an extremely important role in the configuration of political and economic institutions directly involved in the

privatization/liberalization process and, certainly affected the final outcomes. Labor has been identified by scholars like Petrazzini (1995) as one of the most important of the "special interests" from which the policymaking apparatus must be insulated.

Areas of inquiry:

- Do multinational telecommunications companies wield inordinate power in effecting national-level change in countries' telecommunications environments?
- What is the political environment outside regulatory agencies?
- What are the relationships among different political players and how does this affect telecommunications reform?
- What is the relationship between the types of political system (e.g., parliament, independent executive, etc.) and policy directions?

F. The role of the state/government

As organizations like the WTO and the IMF force national governments to reduce spending in certain areas of the economy and encourage governments to privatize resources, the question of the role of national governments immediately emerges. The degree to which national governments have control over their own policies seems to be eroding as foreign capital comes with strict contingencies and/or prerequisites.

Still, we are reminded by Evans et al. (1985) that it is important to "bring the state back into" the analysis. An axiomatic principle in much of the discourse on globalization is that the state should retreat from the economy, in favor of the private sector. Still, the state is called upon,

- To provide infrastructural support;
- To provide subsidies and incentives;
- To absorb sunk costs;
- To validate and enforce contracts and intellectual property regimes;
- To negotiate with other countries on behalf of domestic corporations; and
- To make provisions for communications access and equity.

Abundant evidence suggests that state involvement in creating technological innovation is a necessary, though certainly not sufficient, condition. For example, the notion of "Created Competitive Advantage" whereby competitive advantage can be created through "conscious state policies," is still widely accepted. The examples of Japan and South Korea can easily be adduced here. (For the importance of the state in information economy, see Michael Porter's (1990) argument in The Competitive Advantage of Nations; Manuel Castells (1996) argues that the state is playing an increasing role in national economic and technological competitiveness, despite privatization and digital networks that allow for the free-flow of capital.)

Areas of inquiry:

- Are new sets of responsibilities falling upon national governments as the society is increasingly informatized and globalized?
- How have different national governments reacted when domestic interests conflict with supra-national policies?
- What are the institutional means by which governments attempt to form economic and technology policies and with what outcomes?

G. Structure

The structure of telecommunications companies is largely determined by the requirements of an increasingly competitive global economy, the configuration of which is determined increasingly by supra-national free-trade organizations. Most countries in the West and many countries in other parts of the world have privatized their PTTs and have introduced competition in basic, long distance, and value-added telecommunications services. Most of these telecommunications giants raise capital from global markets and list shares on global stock exchanges, thereby making them subject not only to internal regulation, but market regulation as well. Structure, therefore, cannot be seen as an independent factor but, rather, as reflective of the general economic matrix.

One of the most vital issues is the creation of distinct roles for policymaking, regulation, and management of telecom providers; whereas in earlier eras, these functions were bundled, the rigors of the global market have forced a decoupling of these responsibilities, though in reality these three functions formally or informally been ceded to consortia of large telecommunications providers.

The regulatory changes at an international level have fundamentally influenced the on-going industrial restructuring in the telecommunications sector. In the markets where the PTT model was replaced by a free-market model, we are observing, quite ironically, an enormous amount of corporate consolidations among telecommunications companies. In addition, a number of global telecommunications companies are vigorously purchasing foreign telecommunications assets and interests through foreign direct investments and joint ventures.

Areas of inquiry:

- What are the economic and social outcomes of the transition from the PTT regime to a privatized and/or liberalized environment?
- What are the ramifications of the convergence of ownership, as manifested in joint ventures, strategic tie-ups, and public-private cooperation agreements?
- What is the degree of foreign ownership and foreign direct investment in different countries? How does this affect the reigning telecommunications milieu?

- What effect do corporate consolidations and, generally, mergers and acquisitions have on the telecommunications environment?
- Should countries always engage in competitive bidding processes to win telecom licenses?
- How does the entry of small, nimble competitors in many markets affect the technological and economic characteristics of the prevailing telecommunications environment?

H. Rates

Telecommunications rates or "tariffs" as they are called in many countries have become an increasingly important issue in developing countries since the volume of business transacted over the telecommunications network is exploding. The transition from PTT to private networks generally brings rates down, especially for international calls. Businesses in developing countries continuously lobby their governments to discontinue prices fixed at high rates so that rate harmonization makes their businesses more competitive. However, the reduced international accounting rates threaten the existing cost-allocation schemes among telecommunications providers, who have historically used the lucrative international and domestic long-distance revenues to subsidize local services. As noted earlier, these often entail universal service obligations on the parts of the providers. In addition, most developing countries see high accounting rates as a means to transfer wealth from the developed to the developing worlds. International calls flow unevenly between developing countries and developed countries; developing countries receive more international calls than they initiate. Given the international settlement practice--the settlement fee is paid to the carrier which terminates a call by the carrier which originates a call--developing countries can take advantage of this uneven flow of calls and earn extra cash by setting accounting rates high.

Nevertheless, the majority of nations recognize the economic benefit of reducing international accounting rates along with interconnection charges among carriers. The question is, then, how can we derive the optimal rates for cross-border communications? Accounting rates have historically been determined by a series of bilateral agreements between state-owned monopolies responsible for originating and terminating international telephone calls. The process was rather simple because in many countries there was only one international carrier. However, as privatization and liberalization of the telecommunications sector multiplied the number of international carriers in many countries, the old and new players became much more eager to provide competitive international rates, thus upsetting the heretofore relatively simple process of setting accounting rates.

Equity constitutes another issue regarding telecommunication. There is the perennial demand from business that rates continuously drop as innovation introduces lower cost bases. Yet, as rates decrease, the benefits are experienced differently between different types of services and different subscriber categories. For example, the rate of inter

LATA U.S. toll-service has decreased since the mid-1980s while the rates for local switched service has, in fact, increased.

Areas of inquiry:

- To what degree do changing accounting rates affect the revenue stream of international carriers?
- Will a competitive international telecommunications market compensate for the loss of revenue pools for universal service and other subsidized services? Can we develop models to examine the relationships among the critical variables as outlined above?
- What types of users will benefit the most/least from the decreasing international accounting rates?

I. Procurement

The size and importance of the telecommunications industry makes the procurement of telecommunications equipment a serious issue in the international economy. As in many industries, a few large players dominate the market in switches, networks, cables, and other equipment. Developing countries that do not have national champions to provide such equipment and, thus, have to depend on foreign vendors to create their telecommunications networks, incur certain disadvantages.

The key issue is that few companies globally can provide telecom equipment on a large scale; therefore, national champions of developed countries often become global providers.

Table 2. World's leading telecommunications equipment suppliers

Company	Country of origin	1999 revenue in billion dollars	Percentage of telecommunications-related sales in total sales	Percentage of foreign sales in total sales
Siemens	Germany	73.5	33	46
Lucent	United States	38.3	89	31
Alcatel	France	23.2	67	60
Nortel Networkss	Canada	22.2	Not Available	94

Source: Dow Jones Interactive. [Online]. Available: <http://nrstg2p.djnr.com/>

Developing countries and their telecommunications service providers often have to face oligopolistic structures, dominated by foreign firms, when buying basic infrastructural equipment, thereby hampering any chance they might have of creating an independent development model for their telecommunications environment.

Areas of Inquiry:

- How does the lack of local hardware provision affect the telecommunications environments in developing countries? What are the constraints on indigenous development of telecommunications equipment in these countries?
- Does the necessity of importing telecommunications hardware curtail the abilities of developing countries' governments to determine the process of telecommunications change? Does the reigning imbalance in hardware provision lock developing countries into a liberalization/privatization model that benefits global telecommunications equipment providers and carriers?

J. Technologies

Melody identified new technologies as a "fundamental underlying factor...essential to efficient telecommunication development" (1995, p. 250) and convergence and innovation are key features of telecommunications development.

Convergence

Technological convergence has presented itself as the common goal threading through much of the current technological innovation in the telecommunications and IT sectors. At the same time, technological convergence is closely intertwined with other forms of convergence, namely, regulatory convergence and industrial convergence. From a regulatory perspective, technological convergence makes some of the traditional ways to classify different telecommunications services obsolete. This creates enormous policy and regulatory difficulties. How do regulators handle "international calls" when such calls are transmitted through Internet Protocol networks, in which users mostly bypass the traditional telephone networks? From an industrial perspective, technological convergence has provided an opportunity for corporate consolidations through which separate companies with different technological and service backgrounds join hands.

Innovation

The international telecommunications environment is moving "Beyond POTS (Plain-Old Telephone Services)". Technological developments provide part of the solution to existing problems, such as bandwidth shortage and high costs. But, as consumers worldwide have more advanced needs for telecommunications, plain old telephones services no longer suffice. In this regard, wireless options (such as wireless local loop) are especially promising. For example,

- DSL: delivers broadband services to households and businesses without replacing existing telephone lines. Makes an expanded universal service (basic telephone service plus high-speed Internet connection) economically viable.
- VSAT (very small aperture terminal): alternative to land-based telecommunications trunk lines. Very cost effective in serving remote locations and speedy deployment. Two-way capability.
- LDMS (local multipoint distribution services): wireless alternative to DSL, cable modem, or optical fiber connection to homes and businesses. Limited to urban application because it uses cellular networks, which incurs high cost when extended to rural and remote areas.
- VoIP (voice over Internet Protocol): telecommunications providers are currently investing in the research and deployment of VoIP, which utilizes the Internet backbones to carry voice telephony, bypassing the traditional PSTN (public switched telecommunications networks). VoIP provides an extremely attractive alternative in terms of pricing. However, VoIP challenges the existing telephone regulations by jeopardizing the traditional distinctions between local, long-distance, and international calls.

Technological promises do not automatically translate into actual deployment. Non-incumbent, competitive players develop many new telecommunications technologies. Incumbent carriers (which are government administrations in many countries) may find new technologies a threat to their existing operating environment. Global liberalization of telecommunications services forces incumbent carriers to face the challenges from competitive foreign players. Technological benefits and social benefits or losses should be balanced through effective industrial policy.

Areas of inquiry:

- How will the technological convergence in the fields of telecommunications and IT change the existing industrial structures in these sectors?
- What is the relationship between technological convergence and regulatory changes?
- What are the benefits and costs of adopting alternative transmission technologies in developing countries?

K. Services

There are numerous ways to describe different types of telecommunications services, but confusions sometimes occur as a result of the lack of systematic categories. For example, Frieden (1995) notes the increasing murkiness of the concept of common carrier as a result of telecommunications companies' attempt to parcel out new classes of services and technologies from regulatory obligations accompanying common carriage.

Though classificatory schemes are necessary in any analysis of telecommunications and telecommunications services, technological convergence is fast blurring the distinctions that are highlighted in such schemes. The obeisance to hidebound schemata is currently

causing great distress in the bodies that develop U.S. telecommunications policy. As such, it is of methodological interest for TIPI International to identify different classificatory schemes and the relevance of each. Some of the possible schemes are:

By classes of services:

- Basic services
- Toll services--domestic and international long-distance services
- Value Added services

By different user segments:

- Residential--phone, data (the Internet), satellite
- Business--voice/data, private line/dedicated line, ATM, packet switch, global one-stop shopping (Concert, Global One, World Partners, etc.)

By network types:

- Switched network--circuit (telephone, cellular, GPMCS, packet (Internet),
- Non-switched network--private networks, leased circuits, cable TV

By transmission types:

- Fixed wireline
- Fixed wireless
- Mobile wireless
- Satellite

By regulatory obligations:

- Common carrier
- Private (commercial) carrier

2. INNOVATION CLUSTERS/TECHNOPOLES

In this section, the terms "innovation cluster," "milieus of innovation," and "technopole" are used to refer to any concentration of technology bodies and companies in any geographic location. They are not wholly interchangeable, but for purposes of scanning, they can be read as being largely interchangeable. Technopoles may not always end up being "milieus of innovation," since a mere clustering of technology companies and skilled personnel does not necessarily result in innovative products and processes.

Still, since we are presenting a complicated version of technopoles/milieus of innovation here, the logical differences among these concepts are implied in the text.

The following is a roadmap of this section: Part A addresses the fundamental question of space and place--does place still matter in an economy characterized by almost instantaneous flows of capital and data? Part B discusses the process of agglomeration that leads to regions becoming hubs for innovation. Part C warns that agglomeration itself is not a sufficient condition for innovation; there are many other aspects that are of equal importance in creating milieus of innovation. Finally, Part D outlines some of the major issues in one of the most exciting areas of innovation, namely, software development.

A. Space and Place

Despite the familiar cant that place has become irrelevant in the information society, evidence from most quarters suggests that in fact physical location, or place, is of extreme importance in determining economic and social outcomes. This is true within countries as well as internationally.

The theoretical framework of "central place theory" (Christaller, 1933/1966) underscores the hierarchical aspects of place. Saskia Sassen's (1991) work on "global cities" and AnnaLee Saxenian's (1990; 1994) work on networks and innovation suggest that, in fact, in an increasingly globalized economy connected by digital networks that allow for instantaneous transmission of capital and information, there is a tendency towards concentration—in particular locations such as New York, London, Tokyo. These global command and control centers act as "headquarters" of the global economy.

This entire section on innovation is premised on the importance of place in international innovation, whether because of the role of the state in that region, the amount of capital available there, the number of producer services companies, the availability of a large labor pool, good educational institutions, or simply because of the importance of informal networks that are place-specific.

Areas of inquiry:

- How have canonical ideas of space been displaced by the advent of the intangible commodity called information?
- To what degree is place still an important parameter? How can its importance be described? In other words, do we have the right metrics even to discuss the analytical importance of place?

B. Agglomeration

...technological innovation is not an isolated instance. It reflects a given state of knowledge, a particular institutional and industrial environment, a certain availability of skills... and a network of producers and users who can communicate their experiences cumulatively.

Manuel Castells (1996, p. 37)

Countries throughout the world have realized the importance of technological innovation to economic growth. Many have allocated considerable percentages of their available resources to the creation of a sound technological edifice--given the paucity of financial, technical, and human resources in most of these countries, many have decided to pool available talent in specific geographical locations so as to create a synergistic multiplier effect. The mantra to create new Silicon Valleys is oft repeated in the policy-making halls and chambers of commerce of both developed and developing countries.

There are several key factors in understanding economies of agglomeration: institutional frameworks, government policies, provision of infrastructure, cultural conditions, the existence of social/informal networks, the availability of subcontractors, the buoyancy of local demand, broad "environmental" conditions, and the constitution of labor.

Institutional Frameworks

Institutional frameworks and configurations have been recognized as an important parameter governing to a nation's ability to innovate, to adapt innovative technologies into useful products, and diffuse innovations. Scholars of innovation like Abdu Salam (1991), Manuel Castells (1989; 1996), AnnaLee Saxenian (1994), Christopher Freeman (1995), and Peter Hall and Paschal Preston (1988) have concurred on the need for dynamic institutions to be linked organically with each other and for technopoles or economies of agglomeration to become more than simple linear additions of resources.

The term "institutions" here can be taken in the broadest sense and would include educational, cultural, legal, research and development, chambers of commerce, and citizen panels. Each makes an important contribution to innovation processes.

The ideal model for institutional configuration is also the apotheosis of technopoles: Silicon Valley. There, educational institutions, governments, corporations, chambers of commerce, and legal practitioners work in close collaboration to create an "ambience" for technology.

For a synergistic institutional milieu to take root, linkages between different elements are essential.

The following issues are important when analyzing institutional milieu:

Government Policies

Relevant Parameters:

- Education is an absolutely essential input for the creation of humanware.
- The legal protection of intellectual property rights is necessary condition for innovation and for bringing inventions to market.
- The set of linkages between different intra-technopole actors is of crucial importance.
- The importance of risk capital in the form of finance and venture networks is of the utmost importance to bring a technological idea to market.
- The existence of general credit sources for bridge financing often means the difference between life and death for certain product lines and even whole companies.
- The existence of proactive chambers of commerce and institutionalized networks of business mentors is crucial to the Schumpeterian process.

The following are some policy tools employed by governments to spur innovation:

- Subsidies
- Tax Holidays--whereby companies are exempt from income tax for a given number of years.
- Special "zones" designated for high-technology enterprise; these zones generally have extra infrastructure and are tax-free and duty-free.
- Employment Incentives
- One-window approvals

Infrastructure Provision:

- Telecom/Broadband/advanced services--existence of fast networks servicing large tracts of the population.

- Internet Access
 - Access Fees
 - Availability of broadband access
 - Number of Internet host computers
- Roads/Ports/Airports
- Satellite links
- Constant supply of power
- Adequate facilities for cooling

Other importance factors include:

The existence of social/informal networks: Castells and Hall's work on "Technopoles of the World" (1994) indicates clearly that without networks and linkages, the simple addition of all the "physical" elements is by no means sufficient to create an innovation cluster. In "Regional Advantage," Saxenian (1994) argues that informal networks are the key to the sustenance of innovation clusters.

The availability of subcontracting: Lessons from Silicon Valley indicate the importance of technology and personnel transfer from large companies to small and medium sized "subcontractors" which then become poles of innovation.

Cultural Conditions

Cultural conditions play a huge role in the creation and sustenance of *technopoles*. This is true from many angles:

- General attitudes towards innovation and change have a huge effect on innovation potential.
- The general attitude towards spending is crucial since in many countries, consumer spending drives technological change.
- The nature of work cultures is an extremely important factor in the creation of preconditions for innovation. They should be:
 - non-hierarchical
 - interactive
 - supportive of a relaxed atmosphere
- The degree of Irreverence in attitude structures is fundamental in any scientific or technological enterprise.
 - Feudal structures rarely result in technological innovation.

Generally speaking, there is a dialectical relationship between general cultural conditions and technological strides. Castells puts it very well:

"... in general terms, the closer the relationship between the sites of innovation, production, and use of new technologies, the faster the transformation of societies, and the greater the positive feedback from social conditions on the general conditions for further innovation." (1996, p 37)

Demand

Increasingly, developing countries are adopting export orientations and paying scant heed to the fact that many developed countries created buoyant domestic markets to support investment, R&D, and innovation. Having given up import-substitution industrialization as their model, these countries are paying less attention to the inner urges of their economies and more attention to the needs of developed countries.

The work of Christopher Freeman (1995) on "National Systems of Innovation" highlights the importance of buoyant domestic demand. Fagerberg (1992) reaffirms the importance of the "home market hypothesis," in which a correlation is found between a large home market and innovation potential.

Important considerations here include:

- Downstreaming/Incorporation of ICTs in industrial sectors--Industrial sectors often are a great source of demand for technological goods and services. When technologies are downstreamed into industrial sectors, countries receive the double benefit of creating competitive industrial products and creating a buoyant domestic market for new technologies.
- The nature of domestic consumption--lack of disposable income for consumption or traditional aversion to spending greatly impedes the creation of new technologies in the domestic context since R&D and infrastructural outlays can only be justified if large potential markets exist.
- Export orientation vs. domestic market development- Alternatively a "Walking on Two Legs Proposition" as outlined by Robert Schware (1992) of the World Bank in his paper comparing software industries in India and Brazil. This orientation is largely determined by overall economic parameters and parameters such as existence of domestic demand. Countries have to decide what mix of emphasis on exports vs. building the domestic market most fits their developmental strategies. All too often, countries pick either/or—with disastrous consequences to long term growth.

"Environmental" Conditions

The conditions of life offered to high-skill intensity personnel is a determining factor in their desire to migrate to a technopole. There is a need for the existence of a congenial atmosphere to attract best talent.

Important factors include:

- Good weather
- Access to entertainment
- Access to good schooling facilities

Still, there are tremendous drawbacks to the technopole model, including:

- Pollution
- Horrible traffic congestion
- Soaring real-estate prices
 - Prices all but the elite out of living in the technopole

Labor

The issue of labor is fundamental to understanding milieus of innovation. First and foremost, unlike in an industrial economy, the main asset of technology companies is human resources. Therefore, it is of fundamental importance for a milieu of innovation to be based in an area in which there is an abundant supply of highly skilled labor.

Second, it has been established (see the work of Sassen, 1991; 1996; 1998, and Castells 1996) that milieus of innovation/technopoles/"global cities" arise as such only if there is an abundance of producer services in the vicinity; therefore, milieus of innovation have non-technical labor requirements as well: legal, financial, advertising, media, transportation, travel services, and, of course, blue-collar labor.

Third, since technopoles tend to be concentrations of capital as well as concentrations of upwardly mobile industries, a large sector of technopole labor sees its average wage increase phenomenally. Still, equally large and often larger sections of the populace who are not employed in the managerial and high-skill sectors of the technopole economy see their average wage stagnate or even in cases decline. This process leads to fairly predictable social tensions that government and civic authorities must solve creatively.

Fourth, from an international perspective, the lack of high-skill intensity personnel and sophisticated producer services impinges on the ability of developing countries to create milieus of innovation. Information technologies were created for countries in which high employment prevails; in many developing countries, unemployment and underemployment is endemic and pervasive, thereby calling into question policies that replace labor with technologies.

Key issues here include:

- Technopoles require a large pool and constant fresh supply of educated, high skill-intensity personnel.

- In the technopole, employment in producer services leaps. (See data provided by Sassen, 1991, and Castells, 1996)
- Given the concentrated state of the technopole, wages tend to be pressured upwards for certain sectors.
- Large tracts of the populace are needed for the low-wage, unskilled ancillary services necessary to maintaining a "conducive environment" for high-wage sectors. Thus,
 - Technopoles reproduce class society.
 - Semi-skilled workers see their real wages stagnate or decline.
 - Level of deskilling that creates a permanent reserve pool of labor.
- Conditions of near-full employment and high capital intensity are more conducive to the creation of technopoles.
- Certain aspects of the quality of life are compromised.

C. Agglomeration is not a sufficient condition

In their frenzied rush to recreate Silicon Valleys in their nations, governments from around the world have created conscious policies to create economies of agglomeration. Numerous countries and regions have created thousands of "incubators" to spawn innovative enterprises. Still, many times their policies have not borne fruit.

The main issue is that the simple linear addition of resources is not sufficient, because:

- Organic linkages between institutions are necessary but cannot be mandated by diktat.
- Feudal, hierarchical mode of organizational behavior militates against innovation. Generally planned attempts at technopole creation spring out of the same political philosophy that gives rise to precisely that type of modus operandi.
- According to Saxenian, large, vertically-integrated companies, even if they exist in a technopole, are often not innovative. They tend not to share information and don't properly utilize networks of subcontractors for non-core tasks. Therefore, internal organization is of the utmost importance, despite the macro-factors being in place.
 - Example: Decline of Route 128 (Boston)

Several examples of technopoles that were "artificially" constructed being failures has completely changed the previous notion that putting resources and institutions in physical proximity and throwing money at them will necessarily result in innovation. (See Castells and Hall, 1994, for examples of such abortive efforts.)

Areas of inquiry:

- What does the need for a dynamic institutional framework for innovation imply for developing countries' efforts to recreate Silicon Valley?

- How should developing countries go about creating the synergistic configuration that is the sine qua non for milieus of innovation?
- Does the existence of dominant technopoles like Silicon Valley preclude, through the division of labor, the creation of other technopoles in the developing world?
- To what degree can technopoles be planned? To what degree do they emanate from the general economic and cultural conditions prevailing in the location of choice?
- Does the Internet mitigate the importance of institutional place for innovation?

D. Software Development

Software development is a key area of innovation that runs into the hundreds of billions of dollars annually. While the United States is not only far and away the biggest producer and consumer of software, this is one area in which developing countries can stake a claim. Among developing countries, Ireland and India shine brightly as examples of the ability countries lacking in capital have to create and sell software services and to a lesser degree, products.

There are certain requisite elements that go into the creation of software products and services. When the requisite elements are in place, a software technopole is created. The legendary Silicon Valley is the apotheosis of the technopole.

Silicon Valley is the prime technopole because of the following non-exhaustive list of factors:

- It gets the "best" employees from all over the world.
- It has "routinized" innovation.
- It is characterized by the competitive cooperation among companies that realize that if the pie keeps on getting bigger, so much the better for all concerned.
- According to Castells (1996), this technopole creates a global division of labor that makes its reproduction elsewhere very difficult.

Focus on Developing Countries:

For TIPI International, a focus on developing countries is in order. While most software produced in and exported from developing countries is done so to service the advanced "triad" economies of the US, the EU, and Japan, many developing countries are also making attempts to bolster their relatively flat domestic markets.

Still, the tension between the service and products quantum exists, most developing countries being structurally unable to break into the "traded," "packaged," or "product" software arena. Thus countries like India, with over \$5 billion in software exports, rely largely on services to grow their software businesses.

Services vs. Products

- Developing countries face huge constraints on product development and marketing. Some of the key theoretical parameters for this include:

-Product Cycle Theory--At the innovative stage of the product cycle, high - skill personnel are required in abundance.

-Offshore work/Value-Chain--Since the work that large corporations in the advanced countries outsource to offshore companies is well-defined and low-end, developing countries often stay at the low end of the value-chain, whereas product development is at the high end of the value chain.

-Lack of Domestic Demand--The lack of domestic demand means that software companies in developing countries need to win business from foreign corporations on whom they thus become dependent. Since the work they win is usually low-end and won on the basis of low-cost and not high-skill, these companies remain near the bottom of the value chain. Related factors include: the lack of institutional capacity for innovation and low disposable income so that there is little consumer demand.

Low-End vs. High End services-- most work that is offshored is low-end work that creates technological stagnation.

There are profound institutional inadequacies in developing countries that militate against the possibilities of creating innovative software products. Since software development is not an isolated instance, but emanates from a whole set of requisite factors, developing countries, lacking many necessary elements, cannot compete on equal parley with the advanced economies.

Fundamentally, there is a lack of milieu of innovation; this includes,

- Institutional incapacity for innovation
- Lack of Venture Capital/Risk Capital
- Lack of adequate educational infrastructure
- Lack of linkages between different institutions
- Feudal workplace culture
- Lack of circulation of personnel
 - The circulation of personnel is shown by Saxenian to be of vital importance in maintaining continual innovation.

Possible Remedies:

- Enlightened state involvement. "Created" comparative advantage by the state--in conjunction with other actors is the only way out for developing countries
- Diasporic networks transferring capital and technology (China, South Korea, India) is an incredible way of upgrading technologies and humanware.
- Revamping of financial institutions and entrance of venture capital firms is afoot in many developing countries; this will have profound effects on their abilities to compete in the global marketplace.
- Many countries are upgrading their skills by the process of "learning by doing"--a slow movement up the value chain often results.

Developing countries that are exporting over \$5 billion/annum

- Ireland (see www.nsd.ie)
- India (see www.nasscom.org)

(Nature of the software work is an important factor here--is it high-end or low-end?

Note: Software Creation is not an indivisible black box; there are high-end and low-end functions. Information intensity is NOT synonymous with capital intensity.)

Areas of inquiry:

- Is software development really possible in small countries without an existing Science and Technology base?
- How do developing countries move themselves up the value chain?
- What factors militate against the creation of products in developing countries?

3. ELECTRONIC COMMERCE

It is forecast that electronic commerce will grow to \$4 trillion by 2003. The sheer increase, actual and estimated, in the volume of e-commerce is impressive. Much more intriguing, however, is the dialectic that is being formed between e-commerce and the social, economic, and policy milieu. How will e-commerce influence fundamental conceptions such as "place"? Are existing regulatory frameworks equipped with the capacity to face the digital economy? How will the industrial and market structure change? Where will consumers fit in the picture, and how? These are some of the questions we are facing today, and the following discussion constitutes a launching pad for our inquiry.

A. Space/Place

A familiar notion in the information age is that e-commerce obliterates the importance of place. The idea is that the web is fundamentally distributed and virtual, so that physical location is not a huge consideration. Thus, the rhetoric goes, the Internet levels the playing field and affords business opportunities to anyone anywhere.

Some small and historically less powerful countries are increasingly counting on this promise when they formulate industrial policies. These countries attempt to tap into the global economy through a technological channel, that is, through e-commerce. Vogel and Gricar (1998a) call them "small countries with big footprints." For example, based on sophisticated telecommunications and digital infrastructure, Singapore became an "intelligent island" and established itself as the financial and communication hub in the South East Asia (Tan, 1999). In the Balkans, Slovenia has emerged as one of the world's most rapidly advancing technological centers by consciously making industrial policies around technologies in general and e-commerce in particular (Vogel & Gricar, 1998b).

In some ways, such developments challenge the traditional notions of space and place. However, evidence suggests that the cant of place-independence is suspect and that, in fact, successful e-commerce companies require a host of other services and technological support; therefore, being in a "technopole" is important. Consider the following:

- E-vendors have to be located in areas of broadband connectivity.
- E-buyers have to be located in areas of connectivity.
- Regulation and policy frameworks depend in some respects on area of location.
- Traditional methods of delivery (UPS, FedEx) are still used, so that location near transportation hubs remains important.
- Fulfillment is done manually (e.g., Amazon.com).

Areas of inquiry:

- Where do e-transactions reside?
- What are the characteristics of areas and regions that are emerging as prosperous e-commerce sites?
- Successful development of e-commerce may require intensive cooperation between businesses and the state. Does this requirement make e-commerce more place-bound than the proponents of the placelessness of e-commerce suggest?
- How are rural businesses reacting as online transactions become ever more popular? Does e-commerce provide business opportunities previously unavailable to rural regions or developing countries?
- Where are the e-buyers physically located?

B. Taxation

Many governments view rapidly growing commerce on the Internet as a potential new source of tax income. At a minimum, they do not want to lose existing tax revenues to the new medium. However, e-commerce challenges the existing tax systems because it is precisely the effect of the Internet to entangle the definition of tax boundaries upon which all tax codes in national and local levels in all countries are built. As Whinston et al. succinctly put it, the central taxation question e-commerce poses is to determine "what is being taxed, who should be taxed, and who can impose taxes" (1997, p. 489).

Even within a single country, it is difficult to reach a consensus regarding this question. For example, when the U.S. Congress passed the Internet Tax Freedom Act in 1998, which would essentially minimize e-commerce taxation, the legislation failed to gain support from state and local governments, who saw the law as detrimental to their tax collecting ability. In the international context, e-commerce taxation is a point of dispute among different countries and organizations. While the United States and the WTO endorse the idea that customs duties should not be imposed on e-commerce, the EU only partially agrees with this notion and proposes to impose the Value Added Tax (VAT) on e-commerce that takes place within the EU member countries. Harmonization in e-commerce taxation has not yet materialized.

Two organizing schemes have been identified by tax scholars and government authorities in envisioning future tax codes for e-commerce.

1. Types of taxes: The government can choose from sales tax (taxed on the sellers but also passed on to consumers), consumption tax (taxed on the end consumers), and/or income tax (taxed on the sellers).
2. Types of goods/services: Should the same tax codes apply to both tangible and intangible (e.g., software) goods and services.

The basic question revolves around the question of "neutrality":

The concept of "neutrality" deals with the following fundamental question: Should the same tax codes be applied in any situation? With regard to e-commerce, neutrality implies that the existing tax frameworks, which were developed for non-electronic commerce, are sufficient to handle e-commerce taxation.

Governments and tax authorities must formulate the best recipe by considering all variables. The ultimate goal for the national governments in most countries is to institute an optimal tax framework that clears the way for the development of e-commerce while maintaining an adequate level of tax collection. As we will discuss in the next section, e-commerce potentially further empowers existing large corporations without granting the same level of benefit to small and new players. Less stringent tax codes for e-commerce advocated by many countries and institutions may exacerbate such a tendency, thus prolonging the history of limited forms of competition or oligopoly in many industrial sectors.

Areas of inquiry:

- Is it possible to determine the "location" or the residency of buyers?
- Is it possible to determine the location of the sellers? Whose tax laws will be applied when the seller's headquarters, the Internet server which takes sales orders, and the distribution center are located in different tax jurisdictions (in different states, different countries)?
- Do governments have the technological capacity to ensure a taxpayer's compliance with tax codes?
- Is there an administrative necessity to make a "backdoor" in e-commerce transactions -- especially encrypted transactions -- to be used by tax authorities in order to detect tax evasion?
- How will the composition of tax codes variables (i.e., types of taxes, types of goods, and neutrality) change when e-commerce becomes more pervasive?

C. Supply chain/ Industrial structure

Because of the high level of fluidity in all aspects of digital transactions, e-commerce potentially alters the old industrial structure based on the separation between the producer, distributor, retailer, and consumer. Particularly interesting is a popular view that the greater access to information enabled by the Internet would wipe away intermediaries (e.g., wholesalers, distributors, etc.) from the supply chain. However, as Jin and Robey (1999) point out, the Internet economy still provides opportunities for intermediaries between sellers and buyers. In fact, we are observing the emergence of "cybermediaries," of many different varieties. There are auction companies that constitute an intermediate step between buyers and sellers, B-to-B sites, commerce sites that act as cyber-middlemen, and web-enabled finance/trading companies that are go-betweens between buyers and sellers.

One of the fundamental requirements of a competitive marketplace is the free flow of information. Buyers and sellers use market information to make sound economic decisions. E-commerce, and its underlying technologies and infrastructure, promises such a resource on an unprecedented level. However, modern industrial histories in most countries are characterized by a tenacious effort by corporations to control and restrict the flow of information in order to maintain a hierarchical relationship between sellers (corporations) and consumers. On the one hand, e-commerce challenges such a hierarchy by making marketplace information accessible by consumers. On the other hand, corporations are rapidly acquiring sophisticated technological means to control the flow of information, and the ability of consumers cannot match the enormity of corporate capital and resources. (For an analysis of these two prospects, see Grover & Segors, 1999.) Thus, although many envision that competition will bring e-commerce to a higher stage, we must critically analyze the contending tendencies of the new digital economy. (For a critical view of this digital economy, see Schiller, 1999)

E-commerce potentially influences industrial structure also in terms of the relationship between large and small corporations. Industrial dominance by a few giant suppliers has been a persistent feature in many industrial sectors throughout the world. Again, e-commerce potentially alters the relationship between companies of different sizes. Whinston et al. (1997) discuss several ways in which the commerce of the Internet affects the competitive gap between large and small players. On the one hand, the virtuality of the Internet closes such a gap by making the differences in corporate sizes less visible. On the Internet, small companies can present themselves as well as larger, incumbent companies. On the other hand, however, large companies can maintain their market dominance through a variety of means--such as by transferring their "off-line" reputations online, and by exploiting economies of scale based on their product diversity and corporate size.

Areas of inquiry:

- How does e-commerce affect the relationship between these supply components?
- Does the rise of e-commerce jeopardize the industrial dominance of incumbent corporations, or does it enhance their existing market power?
- How can elements of the traditional supply chain be removed and end-to-end pricing differentials thus be reduced?
- Since one of the fundamental ideas behind e-commerce is a reduction in the number of steps in the supply-chain, what effects will it have on labor markets?
- Will e-commerce engender different consumption patterns?

D. Technological Bases

One does not have to be a technological determinist to realize the critical roles played by technologies in e-commerce. Beyond obviously technological aspects such as the

necessity of electronic networks and the requirement for interoperability among the machines involved in electronic communications, technological components fundamentally affect the core values and hence the likelihood of a successful development, of e-commerce. The two outstanding technological issues that reflect core values are transaction security and privacy.

Transaction Security

The core of any commercial activity is the transaction between sellers and buyers, and intermediaries when applicable. In conventional face-to-face transactions, the sellers and buyers have fairly accurate knowledge in terms of when, how, and whether at all each specific phase of transaction (i.e., ordering, negotiation over terms and conditions of sales, fulfillment, and payment) takes place. As more transactional phases migrate to the electronic domain, however, the accuracy of such knowledge (or the means to check the accuracy of such knowledge) deteriorates. For example, when a buyer places an order over the telephone, he or she may actually be calling somebody who is disguising as a seller. Digital transactions over the Internet introduce myriad uncertainties at every step of commercial transactions.

In addition to accurately carrying out transactions, e-commerce also must exclude uninvited third parties from transactions. Electronic transactions, especially the ones over the Internet, are comparatively insecure against eavesdropping and tampering by outsiders. This situation is largely the result of the historical origin of the Internet. The Internet was first developed as a tool for academic research, which by its nature is (and should be) more open and public. It was not designed for commercial applications, and the underlying technologies do not have security as the first priority (for an overview of the security problems of the Internet architecture, see Bellovin, 1989).

While e-commerce policies and regulations certainly fashion the environment in which e-commerce evolves, e-commerce must be equipped with necessary technological capabilities that guarantee secure transactions in order to develop as a viable addition and, more importantly, alternative to conventional commerce. The following are some of the technologies that attempt to achieve this purpose:

- **Authorization:** The purpose of authorization is to secure transactions. Authorization technologies control and restrict the extent to which a person or entity can perform tasks online. In the e-commerce domain, authorization is particularly important for the electronic transaction between vendors and financial clearinghouses-- to process electronic payments. A conventional example of payment authorization is credit card authorization, whereby the vendor checks a cardholder's (buyer's) financial credibility by electronically contacting the issuer of the credit card.
- **Authentication:** The purpose of authentication technologies is to make sure that the "intended" other person or entity is the one with which you think you are communicating. The simplest form of authentication technology is the password.

However, unless the password is encrypted, it is subject to unwanted interception by third parties. A more advanced form of authentication technology is the digital signature, which is an encrypted code that allows the receiver to match the signature to the individual who sent it. As recently as June 2000, the U.S. Congress passed the Electronic Signatures in Global and National Commerce Act that gave electronic signatures and documents the same legal status as physical equivalents.

- **Payment systems:** The possibility of using electronic forms of money was realized as early as 1978 (Chaum, 1985). However, one problem is the lack of electronic money standards. The current situation is characterized by the presence of numerous proprietary systems, among which there is little uniformity. Irrespective of the system, there are two major issues that e-payment systems must address: anonymity (See following section on Privacy) and liquidity.
- **Cryptography:** Cryptography is applied to other levels of technological requirements of e-commerce (e.g., digital signature, digital money), therefore, it is an overarching technological basis. All forms of cryptography require the use of "keys" (algorithms) in one or another. Symmetric cryptography utilizes the same key to encrypt and decrypt a message. In spite of its technical efficiency, symmetric cryptography is not as secure as other forms of cryptography because in the long run keys circulate widely and become "public," increasing the chance of unwanted decryption by third parties. Asymmetric cryptography, on the other hand, uses a set of two different keys--public and private--and provides much more vigorous security protection. PGP (Pretty Good Privacy) is a popular cryptosystem that uses asymmetric technology. On this matter and particularly germane to the work of TIPI International is the set of restrictions imposed by governments on the export of cryptography software and technologies. The issue of national defense is invoked to restrict trade in such technologies. Again, in order for a lubricated trade environment in global e-commerce, there will have to be harmonization of rules regarding cryptography technologies.
- **Middleware:** Within the context of e-commerce, middleware refers to the glue or "plumbing" that allows the communication between otherwise separate application programs running on diverse platforms. The most common e-commerce application of middleware is the software that enables data exchanges between database and web-based application programs. Middleware, which has grown to a \$1.2-billion industry, is an attractive technology especially for small- and medium-sized e-commerce vendors because it can mediate between *existing* application programs-- databases, and other digital resources --thus introducing huge cost savings.

Privacy

Privacy in electronic transactions is paramount in e-commerce. E-commerce by definition involves the communication of valuable personal and transactional information (name, address, credit card number, etc.) over the telecommunications networks. Consumers may be wary of sending information given the perceived dangers of eavesdropping, password sniffing, data modification, and other types of online misconduct (Bhimani, 1998).

Transaction security and privacy considerations share many technological bases. Aside from the technological issues, privacy considerations are important because the development of e-commerce largely depends on the trust consumers put in this new commercial system. Privacy is an issue of such immense proportions that disagreements over privacy policies (such as that which occurred between the U.S. and the EU) can have huge ripple effects in the entire global e-commerce milieu. Again, harmonization is the order of the day.

Issues:

- Ownership and use of information--Who owns the information? How is this regulated? Will the information given to one site be sold or disclosed to another company?
- The lack of policy harmonization threatens international e-commerce
 - U.S. government is reluctant to create pointed legislation--instead, they leave it up to companies on their own recognizance to employ "good faith."
 - The U.S. government is reluctant to set technological standards for consumer protection. Again, it is left up to the companies to do this.
- The mapping and tracing of surf evolution is an important issue.
 - Some sites know what search term is used to find them, thereby disclosing important information.
 - "Cookies" are employed such that historical sessions, along with a great deal of sensitive data, are recorded

Areas of inquiry:

- Should we create a new set of consumer protection mechanisms as e-commerce expands?
- Should privacy protocols be mandated by governments? Should corporations be left to determine their own privacy protocols?
- Are technologies alone adequate solutions for the existing problems of privacy? Since technologies for privacy do exist, is there a political side to questions of privacy? If so, what are the interests involved?
- How can we evaluate the efficacy and outcomes of self-regulation?

E. Intellectual Property

As in much of the discourse in other areas of inquiry, intellectual property considerations loom large in the analysis of e-commerce. Though there is the standard gamut of intellectual property considerations with regard to the technology platforms used by e-vendors, the more weighty issue revolves around the use of the data acquired from customers. Even the slightest intimation that the intellectual property belonging to one

company is subject to being misused by another casts a gloomy pall over all e-commerce transactions.

With international, national, and even local regimes for the treatment of IP issues being implemented, the e-commerce world is increasingly subject to regulatory scrutiny, though in many cases, the sovereignty of the end-user-and not the e-vendor, is being reduced.

From another point of view, an immense row over intellectual property has been created by e-vendors who sell third party content to customers. For example, the various on-line music download companies like MP3 and Napster are being scrutinized as are online purveyors of book content. There are several cases in docket now and likely by the end of the year 2000, a more concrete set of legal protocols will emerge.

Areas of inquiry:

- Should online purveyors of content be subject to the same legal protocols as offline purveyors?
- To what degree is there a preemption of international protocols on IP given the relative lack of enforceability on an international level?
- Does the web as a medium of content delivery fundamentally alter the canonical conception of trade in goods and services and, therefore, call for an entirely new set of regulatory and legal protocols for IP?
- Are there cultural differences in views toward IP and if so, what kinds of initiatives are needed to harmonize these differences so as to create an internationally adhered to set of protocols for IP?

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