The What, Why, Where, and How of National Information Initiatives (1997)

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The comparative study of public policy design and implementation has a long and honorable tradition within the social sciences. While one can trace the modern lineage of comparative policy analysis back to Max Weber, more recent authors include Dye (1972), Rose (1973) and Lindberg (1977). The topics they study span the gamut from social policy to defense, energy and the environment, health care and science policy. As we approach the study of how different countries design and implement their national information infrastructures, we can draw on an established tradition of social science scholarship.

In the development of any body of knowledge, there are always shifting emphases and changing foci. A close reading of policy studies reveals a kind of "product cycle" within each of the substantive policy areas, especially for the newer, more technologically driven subjects like energy, the environment and, more recently, information and communications policies. There appear to be at least four phases to the product cycle.' Each new wave centrally informs the public debate, before a new set of issues. comes to the fore in the next phase. They differ by their arguments, their audience and their principal authors.

In phase one, the technical phase, a once quiescent technical issue handled in the middle ranks of public bureaucracies is propelled into public view and onto the action agenda of senior policymakers. For example, the 1973 energy crisis and environmental shocks like Love Canal or Three Mile Island politicized technical issues and precipitated greater policy attention to these issues (Wilson 1987).

Typically, the works that dominate this phase are authored by engineers, scientists or economists whose purpose most explain the most advanced, cutting-edge features of the new technological issue to other like-minded experts. The policy problem is defined in technical terms, needing a technical solution. Some argue that more and better technology assessment is central to enhancing the efficiencies of government policies and private investment strategies. Autio and Hameri (1995) concentrate on the dynamics and the structure of technological systems in general. In the burgeoning literature on the information revolution, even a casual reading reveals this trend. A powerful technical orientation is not entirely surprising given the central role of technological change in the information revolution, including new technologies for

digitalization, compression and growing computer power.

In the second phase, social theorists take up the issue. This new group of analysts has slightly different purposes and audiences. Social theorists and journalists grab the idea of the technology and find within in it answers to a whole raft of societal problems. Their purposes are more ambitious than phase-one writers, and they seek a broader audience of non-specialists. Their writings are often apocalyptic, hyperbolic, asserting that technique X will utopian, advance democracy, improve the quality of life, guarantee the survivability of the planet, transform international relations (Lovins, 1981). The primary focus of their curiosity is how the new technology will reshape society (Toffler 1990). Information guru George Gilder proclaims that the new information technologies "will blow apart all the monopolies, hierarchies, pyramids, and power grids of established industrial society."2

In phase three, other non-technological dimensions are brought into the picture by a wider group of social scientists. One finds more careful attention to institutional, political and distributional issues. Analysts recognize that diffusion rates for the new technology will be shaped by existing institutional incentives (OTA 1995, pp. 4344). They see that technical changes create losers as well as winners, and begin to analyze the potentially dark side for poor people or poor countries. The title of Burstein and Kline's new work captures this two-sided perspective: *Road Warriors: Dreams and Nightmares Along the information Highway (1995).* The information haves and have-nots are put on the agenda nationally and internationally (Curtis 1988 and Canvass *1995).* Also, alternative or complementary strategies become visible for different firms in the same industry (e.g., Bell Atlantic vs. AMERITECH, or the Apple strategy vs. the IBM strategy). As the scope of analysis widens, observers recognize that different countries, like different firms, can approach the same policy issues in very different ways.

In phase four, the discussion is opened still further and more university-based scholars take up the issue, as much to test traditional concepts and hypotheses from their respective disciplines, as to explicate the intricacies of the topic at hand. This represents the normalization of social science analysis. These successive waves do not replace one another, but over time add to the richness of the available literature. The process is additive. Still, a distinctive gap remains between the technical approach of phase one and the social science approach of phase four, a topic to which I return below.

The comparative study of the information revolution is now sliding from the second into the third phase. My reading of the literature in economics, political science, sociology and business suggests that most of the work today is still rather focused on technical issues, such as standards for interconnection, touting the technical advantage of the Internet or describing the growth of wireless technologies (OTA 1995). Only recently are analysts bringing distributional and institutional elements to the fore. With few exceptions (Evans 1995) we have yet to see the wave of scholarly social science studies that invariably follows the work of industry, think tank or government analysts.

Given this perspective, I wish to advance the debate modestly and perhaps sharpen the discussion by posing a series of research and conceptual questions that draw lessons from the differing experiences of national and global information infrastructure initiatives. This chapter is meant to be useful to academic, business and other analysts anxious to enhance public and private sector performance. While we concentrate on the debate within the United States, there are parallel concerns in other countries. Kumon suggests, for example, that the debates over technology in Japan are also just beginning, to move across professional boundaries and to engage non-technical concerns (Kumon 1995).

What Are We comparing?

Let us agree for the moment that we are comparing and trying to explain the emergence of something frequently cited and variously defined-a national information infrastructure (NII). This is an inchoate, multidimensional phenomenon, a turbulent and controversial mix of public policy, corporate strategies, hardware and software that shapes the way consumers and citizens use information and communications. The U.S. government General Accounting Office defines it as “A popular term for the emerging global broadband digital meta-network” (GAO 1995, p. 72). For Drake, from a strictly network perspective, the NII is “an extremely heterogeneous collection of local and regional information infrastructures and long-haul networks ... [whose] component parts will be developed at different rates and organized in different ways” (Drake 1995a, p. 4). Finding this definition insufficient, he reformulates it to “the computerized networks, intelligent terminals, and accompanying applications and services people use to access, create, disseminate, and utilize digital information” (Drake 1995a, p. 5, emphasis added). Most observers would agree that a sensible definition of an NII would include some combination of the following elements.

Technical Systems

Technical systems are at the heart of the NII, which can be described in highly technical terms, and usually is (Solomon 1995). The Internet, landlines, satellites or telecommunications systems linking local, national and international users are often the principal subjects of cross-border comparisons. Here one concentrates on the design, distribution and uses of the hardware and the software systems that comprise the national “networks of networks” (OECD 1995). Looking comparatively, are there significant cross-national differences in the architecture and interconnection of the various constituent technical subsystems? For example, technical systems can be more or less open, more or less integrated, and each country has different penetration rates for different technologies, often using different standards. An alternative technical formulation is to define different levels or layers of information systems from transport,

to local networks, to applications and management (GAO 1995, p. 12). A big split in the literati-ire occurs between those who emphasize telecommunications as the core of the NII's technical system, and those who give pride of place to the Internet and other digitized, multimedia technologies Kahin 1994).

Sectors

Others start their analyses of the NII with the structure and dynamics of economic sectors of the economy (Wellenius & Stern 1994). Market structure and industrial organization are central to this approach. Peter Cowhey and others argue that the key to understanding the differences between the NII in the United States and the NIIs in Europe, for example, is their different market structures. Uniquely among its competitors, the U. S. market for the supply of information technology (IT) goods and services is characterized by a very wide range in the size of firms and variability of market niches. The NII in the United States has firms across virtually every information market, from small start-ups in everything from software to long distance services, to medium-sized companies, as well as huge Fortune 100 corporations. By contrast, European supplier markets possess telecommunications and large firms (many state-owned), but lack the wealth of small, newer firms that add depth, innovation, commercial diversity and distinctive political dynamics to the U.S. political economy (Cowhey 1990,1995). Europe's more protectionist, top-down approach to the NII reflects these differing market realities. Therefore, to compare NIIs through a sectoral approach, one begins with the structure of domestic markets (and, for political economists, the interest groups and backers that form around those distinct markets and firms). One examines cross-nation ally the relative size of the sectors,, changing market shares, and degrees of vertical and horizontal integration of each of the relevant industries that together constitute the information/ communications sector (computers, software, systems integration, telecommunications, etc.). This sectoral approach to the NII quickly leads one to consider the critical, if very difficult, issue of convergence. Convergence is the merging of distinct IT industries and the creation of new ones made possible by digitalization (Institute for Information Studies 1994). Arguably, convergence is the single most critical dynamic shaping the NII and the Global Information Infrastructure (GII) today, driven by the interaction of new technologies, fluid corporate restructuring and emerging and intersecting markets. The resultant new "digitized" industrial structure has enormous implications for corporate strategies, and for the design and implementation of regulatory policy. This is an essential area requiring much more national and comparative work.

Government Policy

Governments play a huge role in the construction and management of N11s. At a minimum, the comparative study of N11s must study the actions of governments (Rose 1973). There are at least two subsets of relevant government policy actions one could compare and contrast:

Generic Policy issues: How does the information/ telecommunications sector handle the most basic policy issues that confront all governments and all sectors? These include determining the relative balance between monopoly and competition; between public and private control; and between foreign and domestic ownership. These policy questions, which are addressed by comparativists like Peter Hall and Andrew Shonfield (1969) are major issues in all sectors, including IT.

Industry-specific policy issues: Each industry, from health care to transportation, is characterized by specific issues particular to it. For the IT industry, these include intellectual property rights, interconnectivity, universal service, open markets and others (OTA, 1995). Traditional IT issues are also reshaped and redefined by new issues such as the growing trade in information services (Aronson and Cowhey 1988). Perhaps the greatest crosscutting challenge in analyzing the GII, which practitioners and policy analysts recognize, is to understand the dramatic reduction in government's direct ownership and control of the IT industry, and today's more liberalized environment in which the authority of the private sector has dramatically grown.

Institutional Structures

Another way to define the NII is as a set of interlocking institutions that together guide or constrain the behavior of consumers, suppliers, public officials and citizens. Much of the work in the comparative policy field concentrates on the organizations and institutions responsible for designing and implementing particular policies (March and Olsen 1989). Mintzberg (1983), for example, insists on the importance of both the internal structures and the immediate organizational environment of large policy organizations. Hahm and Plein (1995) analyze the role of the institution of the presidency in technological development in Korea. Saumon and Puiseux (1977) use organigrams and flowcharts to capture the essence of French energy policy from an institutional perspective.

In his work on national energy policies, Lindberg compares several national cases and points to the great difficulty that governments have experienced in coordinating the contradictory roles thrust upon them in the course of the evolution of the energy problem (Lindberg 1977, p. 335). National policymaking, in his view, is characterized by "fragmented and incoherent policy making" within the government, and contention with competing groups and a powerful "industrial technocracy" beyond it. Institutional analyses are starting to appear in the NII literature as well. Geller echoes Lindberg's findings in his "Reforming the U.S. Telecommunications Policymaking Process," where he characterizes the U.S. system as continuing the "defects of a generation ago-the

antiquated law, the fragmented policy process, the absence of FCC commissioners with deep experience in telecommunications," but the costs of fragmentation are much greater than ever before in the face of convergence and globalization (Geller 1995, p. 116).

A recent comparative volume on telecommunications in transition compares a range of institutional issues including the role of the Organization for Economic Cooperation and Development(OECD), the General Agreement on Trade and Tariffs (GATT) and legal initiatives of the European Union (EU) (Steinfield, Bauer and Caby 1994). The strong version of this argument is that the NII is not just a technical system, but is best understood as an interlocking system of institutions whose rules and incentives shape the technical, commercial and civic actions of information consumers and producers. This "institutions first" position can be counterpoised to the "technology first" position described above.

Sub-national Groups and Individuals

The intentions, interests and behaviors of self-interested groups and individuals in markets and political settings are important determinants of policy outcomes and also may be the focus of comparative NII studies (Dye 1972). Self-interested maneuvering can occur in every kind of national and international policy arena, as groups and individuals jockey for position and relative advantage. The press has documented the extraordinary multiparty lobbying and almost -unprecedented expenditure of money that swirled around the passage of the 1996 telecommunications legislation in the United States.

In the information arena, Dowmunt and his collaborators pinpoint grassroots efforts by local community groups to create their own video records and gain access to national and urban communication systems (Dowmunt 1993). Ronfeldt's path-breaking work combining information revolution trends with sophisticated political and institutional analysis of non-governmental organizations (NGOs) is also noteworthy (Ronfeldt 1993). Drake concentrates on more conventional lobbying by NGOs to influence national telecommunications policies (Drake 1995b).

Culture, Communications and Media

There is a distinct intellectual tradition of research and writing that defines communications and information issues more from the perspective of content, freedom of expression and culture. With a very different research agenda derived from broadcasting and media concerns, publications like the *Journal* of *Communication, Critical Studies in Mass Communication, European Journal of Communi*cation and others take tip these content-related policies. These concerns are sometimes expressed in the U.S. debate over the NII but arguably have played second fiddle in the press and policy discussions to the more economic and telecommunication s-related themes of pricing, regulatory reforms,

competition and other market- and technology-oriented issues. While these two streams of analysis have tended to be quite separate, with digitalization and growing technological convergence we will see more and more "boundary conflicts" between them. "Government media policies can no longer be exclusively guided by cultural values, and telecommunications should also pursue objectives outside the technological and economic field" (Cuilenburg and Slaa 1993). Future definitions of national information infrastructures in the United States and the United Kingdom will almost certainly encompass more concerns about content, audience and culture. Already, intellectual property rights, v-chips and French cultural requirements intersect both domains and are among the most politically charged controversies in the field.

Smart analysts recognize that all these elements are important and should be carefully weighed and balanced in any serious study of the NIL However, in their definitions of national information infrastructures, most authors stress one factor over the others. The challenge is to appreciate what is gained and lost in employing or rejecting different elements of a definition.

An unavoidable question naturally arises: shouldn't one be highly skeptical of a strictly *national* approach to explaining information and communications developments, given today's global markets and cross-border transactions? Since technology, globalization of production and international competition have rendered national borders superfluous, then the study of information infrastructures should be strictly global and not narrowly national.

The current debate over the global information infrastructure, and the references at meetings of the Group of' Seven leading industrialized countries (G-7) and other international gatherings to the information haves and have-nots, occurs against the background of an already established body of work. Much of it concentrates on the interactions among nations within the international community, especially on the information disadvantages of poor countries and the relative advantages of the rich (Frederick 1993). Gonzalez-Manet (1992), a Cuban writer, takes a left cut on international information equity, reminiscent of the debates over the "New International Information Order" in the 1970s. Hamelink's (1994) work gives a detailed historical review of the evolution of institutions, arguments and policy decisions in the field of international information and communications relations between the North and South.

However transnational the issues may be, national politicians and policymakers first calculate their consequences at the national level. The issue of winners and losers for governments and their political leaders will be calculated mainly at the national level. Most telecommunications firms serve national markets. Regulatory structures are put in place mainly to structure domestic markets, not foreign ones, for the benefit of local suppliers and consumers.

The most interesting and important questions for business today are institutional and political, posed and answered at the national level. This argument does not deny the

importance of global factors; rather, it insists that an essential starting point for understanding even the global information infrastructure is the national political economy. This approach recognizes that important telecommunications rules and regulations will be written in international and regional fora like the International Telecommunications Union (ITU), the World Trade Organization (WTO) and the European Union (EU), but insists that the outcomes will express preferences negotiated by national governments.

Why Are National Information Infrastructures Different?

Whether comparing technical systems, market structures or group behaviors, we want to account for cross-system similarities and differences among them. Why do some NIIs quickly incorporate the newest information technologies (e.g., Finland has one of the highest rates of cellular phone penetration in the world), while others lag behind? Why are some countries innovators in telemedicine, but not in distance education? Why has post, telephone and telegraph (PTT) privatization proceeded further in Chile than in Brazil? Taking NII structure and performance as the dependent variable to be explained, what independent variables have caused these differences to appear in different countries? Here the challenge is twofold-to identify those cross-national differences, and then to speculate about their origins.

The comparativist can generate any number of hypotheses to explain variation among NIIs. For example, can we explain Finland's high cellular phone penetration rate in terms of enlightened government regulatory policy or the structure of the domestic supplier industry where Nokia, the world class competitor, is based? Why do two countries at the same level of development have very different NIIs? Dependent variables could include varying degrees of political centralization vs. decentralization; differences in gross domestic product per capita; corporatist vs. non-corporatist forms of interest mediation; market structure; or differing national research and development strategies.

Why Are We Comparing?

Martin Staniland (1985) and others identify at least two purposes of analysis and explanation. On the one hand, scholars are mainly interested in explaining the complexity and depth of a topic (George 1993). Their purpose is general understanding for its own sake. Sophisticated scholars seek to test hypotheses derived from general models against the facts of the case at hand. They seek alternative explanations to account for the same facts, and their conclusions are often indeterminate.

On the other hand, corporate strategists and policy analysts are action-oriented. They seek guides to better action, not ' just better understanding. They seek information that allows them to shape public policy or corporate strategy in order to advance the

purposes of their home unit-to expand market share, increase earnings, shape citizen behavior, etc. Knowledge is instrumental. These differences are as evident in the field of information and communication as in others.3 For example, one can contrast Stephen Krasner's abstract, scholarly and model-driven treatment of the International Telecommunications Union and other telecommunications organizations with the more applied evaluations of Rutkowski, the ITU and the World Bank (Krasner 1991, Rutkowski 1995, Tyler 1993, World Bank, 1995). National-level studies can be extremely -useful for State Department desk officers, Commerce Department officials at overseas posts or newly appointed country representatives from IT companies.

How Are We Comparing?

Each discipline has its own way of describing the world. It makes a huge difference to dispassionate understanding and to partisan action if the analyst begins with the underlying assumptions of methodological individualism of neoclassical economics, or instead with the group-oriented pluralist political analysis of Robert Dahl (1961). Does the paradigm assume perfect information and a rational selection of goals and strategies by self-interested individuals? Does it assume a neutral, nonpartisan state? Or does the paradigm begin with the standard operating procedures, entrenched institutional interests and muddling through, or 11 "satisfying" behavior of organizational analyses? (Allison 1971). No single approach is ideal; they all have their blind spots in understanding topics like the information revolution and comparing their incidence cross-nation ally. These differences can translate into public policy (Keyfitz 1995).

Regrettably, at this moment in the study of the information revolution we lack even minimal agreement on what constitutes an inclusive, high-quality NII study. There is little discussion of the methodological issues I identify here-what, why and how. In essence, the debate is not yet fully engaged either within disciplines or across them.

What Is Actually Available To Compare?

It would be ideal if we had rich empirical descriptions and detailed materials on the NIIs of all countries, but we do not. There appear to be very few country studies which integrate the many elements of N11s into a single work. More common are national or regional studies that review a single element of the NII, such as broadcasting, the print media or telephony.4

Instead, one is obliged to work with incomplete information. Data-based studies by international agencies like the superb tables of the ITU, and the commercial equivalents by companies like DataQuest, provide discrete facts-telephones per capita, spending on computer R&D, etc.-but these are rarely integrated into a whole picture of a country's NII. Another source for further comparative work comprises the official

studies and reports by national governments, reports by international organizations and analyses by independent scholars and researchers.

More and more governments are preparing their own national reports describing and characterizing their own information/ communications situation. The two principal U.S. government documents are US NII: *An Agenda for Action (1994)* and GIL *Agenda for Cooperation* (1995). National studies also exist for Denmark, Canada, France, Singapore and Japan (OECD 1995).

International organizations have also been quite active. One well known for its cross-national policy work is the OECD. In a document dated June *13-14*, 1995, the OECD reports on current or proposed actions for the N11s of 12 leading member states and tries to identify similarities and differences among them (OECD 1995).

The OECD document is organized around a set of initial definitions and the identification of common economic, social and cultural objectives of national IT policies. It finds that, despite some differences in the definitions, underlying terms such as "information infrastructure," "information highway," and "information society" present

> a concept based broadly on broadband communication technologies which, through the process of digitalization of communication infrastructures, the convergence of these technologies with broadcasting technologies, and recent developments allow rapid transmission of large quantities of information at low cost. Broadband can carry integrated data, video, text and voice traffic. (OECD 1995, p. 5).

The national reports typically go beyond pure technology to discuss "the potential impact these technological innovations have on modern society and the potential economic and social benefits [they] provide. In this sense the term information infrastructures refers to the ability of new technologies to transform the way we work, play, learn and live." Indeed, the report emphasizes the continuing diversification and sophistication of the demand side of the equation. It points out that existing structures at the macro, meso and micro levels are gradually changing" (OECD *1995, p. 5).

The OECD report is a consensus document of shared or leading themes among, 12 countries, discussing ten key issues found in most national reports on the subject. It highlights areas of agreement or disagreement on each issue. Although it is a useful compendium of national initiatives and intentions, methodological, concerns are not much evident here; there is little effort to pick and choose and establish mutually agreed upon. approaches to constructing national baselines for comparison. The report does find common understandings about the meaning of IT (broadly defined to include digitalization, convergence, etc.); however, it does not suggest causal relations among the factors. At best, it is a kind of policy catalogue; it is not a research agenda or strategy.5

Other international organizations are also involved in the effort to collect and

evaluate new information and communications data. The World Bank is shifting toward an innovative framework for analyzing NIIs through "knowledge assessments" and "national information strategy systems." These tend to be more methodologically explicit and well developed than those of the OECD, reflecting perhaps the applied and programmatic purposes of the Bank (Talero and Gaudette 1995). While there are general analytic Bank reports on IT use in Asia or Latin America, there are not yet many publicly available country studies of the sector. One hopes that the Bank's new INFODEV project will produce country studies that will be available to researchers beyond the organization.

Independent scholars and analysts have also done solid. comparative work, as is evident in *Telecommunications Policy* and other sector journals. Drake (1995a) is another example. These works address methodological and substantive issues, tend to be more critical of government actions and more clearly identify winners and losers than do official reports. Still, phase four has not yet arrived-it is telling that there are very few studies of international telecommunications and information in the leading policy and political science journals. With the exception of Cowhey (1990), Evans (1995), and Krasner (1991), few leading scholars have done serious academic work on the subject. By far, most of the work is in more applied professional journals *like Telecommunications Policy.*

So What?

The devastating "so what?" question is as important as the others which have proceeded it. Why should anyone care about comparative political economy analyses of national approaches to the information revolution?

The analytic approach I suggest here responds to both scholarly and practical concerns. A private sector group, the Global Information Infrastructure Commission, asked its 30 commissioners 9 all of whom are CEOs or very senior officers in the private sector and. in governments, to identify the most critical issues that directly concerned them and, their company. Invariably they identified institutional and political impediments to building the GII as their primary concern. The CEOs are seeking ways to advance political and strategic agreement among themselves and. between their firms and governments on key matters like setting standards, market access, and pro-investment regulations and laws. Their concerns are not to find the one best technology or the single most efficient computer software package. There is no denying that these technology and product development challenges are very important to companies; if they do not continually improve their products in. today's extremely competitive markets, then they will be out of business. Still, analysts can only describe and seek to manage operations in this dynamic. environment if they possess a sure-footed understanding of key public and private actors and their strategic interests, as well as the changing rules of the game, other actors' preferred outcomes, and who is likely to win and lose from various resolutions of the critical issues. In other words, the CEOs are concerned. about issues of political

economy.

For private corporate actors, therefore, the response to the "so what?" question about the value of national case studies must be nuanced since the opportunity cost of studying any one issue over another is greater than in the university. Corporate analysts will compare and contrast NIIs when doing so is relevant for core business activities like sales, investment, market openings, competition, souring and government relations. For them, national studies may be especially useful in newly emerging markets (e.g., Vietnam, South Africa) where national information is more scarce. The work of consulting firms like the British company, *Analysys*, are especially important in this respect.

Government officials also need case studies. While no two countries will ever have identical NIIs or identical policies, lessons can be learned on such issues as how to sequence communications reform decisions, or the possible benefits and costs of alternatives institutional and regulatory arrangements (such as separating posts from telecommunications or using price caps). At a minimum, decision makers, especially relatively inexperienced ones in developing countries, can be made aware of the particularly crosscutting nature of information issues (Wilson 1995).

For scholars, the answer to "so what?" is more straightforward: like mountain climbers, they reply, "Because it is there." The payoff' for traditional scholars comes in contributing to theory building. Still, the issues raised by the information revolution are important from the perspective of many academic disciplines, from economics to international relations, to the sociology of work and industrial relations. And, as indicated, there is a long tradition of university and think tank-based interest in the study of policy domains.

Let us take one example of a major substantive issue usefully addressed through comparative national studies, with benefits for both scholars and practitioners. The search for "best practices" is now a growth industry from China to Chile. Companies and government agencies are feverishly seeking information on new successes in areas ranging from technical applications to regulatory reforms to technology diffusion. They want to find what works. They seek successes in one country to apply in their own. This is a useful exercise. However, there is a real danger that companies or governments will use "quick and dirty" superficial comparisons to latch onto an initiative or technology that appears to work in one national setting, and automatically apply it to another setting, hoping it will work there too. By concentrating on the application or government action isolated from its unique local context, the analyst misses the institutional, technological, political and even cultural features of the environment that made possible the initiative's success. Also, further analysis may reveal that an apparent success in one delimited domain may generate substantial and unacceptable costs in another. These nuances and insights can be captured through comparative national studies.

What Should We Do Now?

At this stage of our analysis of national information infrastructures, the greatest benefit for intellectual and applied purposes will come from posing tough institutional, political and distributional questions about national information systems in a variety of countries, rather than reproducing specialized technical studies for narrow audiences. In terms of my opening argument, we need to turn to phase-three issues.

An excellent example of an effective political economy approach to phase-three issues is the Office of Technology Assessment's 1990 report, *Critical Connections* (OTA, 1990). That study linked the existing communications regime, interactions between technology and society, the opportunities and constraints the new technologies created, the response of "key stakeholders and decision making processes" and the outcomes of those decisions about new technologies (OTA 1990, pp. 34-35). The OTA defined information and communications in terms that could also define the core of the NII:

a. norms values, goals and roles that sustain and maintain communication within a given realm;

b. communication infrastructure that supports and facilitates communication processes; and

c. decision making processes and the rules and regulations that govern how the communication regime is managed and regulated. (OTA 1990,p. 35).

(Appliances and consumers can be added to this formulation to make it more complete.)

To compare NIIs more successfully, we need more and better information. Ironically, there is a dearth of good national information on the information revolution. Ideally, we need all kinds of information and data simultaneously and quickly. But in the real world of constrained resources and opportunity costs, some things are more important than others. I believe the following should be the comparativist's top priorities.

- *Case studies of NIIs in a variety of countries, large and small, developed and underdeveloped. Where possible, case studies should consistently compare two or more comparable units-countries, policies, markets and so forth. At a minimum, we badly need rigorous single cases. These cases should go beyond telecommunications to include descriptions of what Talero calls "strategic information systems" that encompass not just technology, but people, work processes, incentives, data, transactions, constraints and outcomes. Therefore variables such as policies, institutions, existing rents, business processes, organizational arrangements, power structures and even social organization are indispensable aspects of successful [strategic information] systems development."(Talero 1994, P. 19).*

- Hypotheses *that are explicit and used to guide empirical research, and that can help answer critical questions.*
- A political economy *approach that concentrates on institutional players seeking to redefine dominant rules and norms as the information and communications revolution unfolds; an approach that identifies patterns of winners and losers that emerge domestically and internationally (Mansell 1993 Mosco and Wasko 1988). Analysts need to concentrate on the rules of the game as they are contested national and international fora as digitalization, convergence, and falling costs undercut old commercial and social patterns and create new ones.*
- *Substantively, identify and analyze the central dynamic of the,* expanding authority and. power of the private sector *in IT.*

There are, of course, other issues that can usefully be analyzed to help move the study of this important transformation toward phase four, toward a more “normal science” approach to information and telecommunications policies and national information infrastructures. But these four constitute a good start.

Notes

1. There are a variety of ways to think about different phases or shifting emphases. Emmanuel Mesthene (1986), head of a Harvard tech note, in the 1960s, identified three schools dealing with the introduction of' new technologies, which might be summarized as: technology is really good; technology is really bad; technology is no big deal. A related theme is how sonic issues get, defined as problems or opportunities, and are then placed on the policy agenda. Rochefort and Cobb (1994) recently identified six factors that shape whether and how an issue like information and communications gets on the public agenda, including the issue's severity, incidence, novelty and proximity. The tremendous growth of attention to the information revolution, with cover stories in news magazines and as the subject of best-selling books, suggests this is happening. Rochefort and Cobb remind us that problem definition is not always neutral; it is "at once to explain, to describe, to recommend, and above all, to persuade"(1994).

2. The Gilder quotation continues: "It will undermine all totalitarian regimes. Police states cannot, endure tinder the advance of the computer because it increases the power of the people far faster than the powers of surveillance. All hierarchies will tend to become 'heterarchies'-systems in which each individual rules his own domain. In contrast to a hierarchy ruled from the top, a heterarchy is a society of equals under the law." (Drake 1995a, p. 10).

3. Examples of national and regional studies include Michalis' (1994) on Greece piece oil, the *Journal of Communications* 1994 back-to-back five-article collections on media in China (Vol. 44, No. 3) and on Latin American media (Vol. 4-4, No.4). While most of the work is on NII policy in the developed world, one can cite the national study of Kenya by Akwule (1995) and the regional focus of Bourgault (1995). The Third World as a whole is analyzed in the Lerner and Schramm classic of 1966, and Geoffrey Reeves' more recent *Communication and the `Third World'(*1993). But, systematic comparisons of two or more NIIs or institutions are rare in the literature.

4. Corporate research and development in information and telecommunications art-, the subject, of consultant reports, organizational studies and conferences. IIR Ltd. in conjunction with several information and telecommunications companies sponsored the First Annual Symposium on Research and Development Telecommunications, in which topics relevant to national information infrastructures included EU policies for supporting research, "Examining the, Development of Emerging Markets as a Source of R&D Excellence," and "Making Effective Use of the Opportunities for Collaborative Research with Academic Institutions."

5. Somewhat more helpful was the OECD workshop on “The Economics of the Information Society,” Toronto June 28-29, 1995. The latest OECD document, a synthesis report, advances the debate even further (OECD 1995).

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Enhancing youth employability: What? Why? and How? Guide to core work skills / Laura Brewer ; International Labour Office, Skills and Employability Department. - Geneva: ILO, 2013.Â initiatives. There is potential to extend this effort more widely in the Training for Rural Economic Empowerment (TREE), local economic development and intensive investment projects, amongst others. Given this potential and opportunity to learn more from its implementation, the guide will remain a living document as additional approaches and concrete illustrations are gathered, which will be incorporated into a later edition. To define a finite list of criteria, this paper refers to the six "WH" questions (Who, Why, When, Where, What and How), which are largely used in the literature for different purposes, such as characterizing, examining or analyzing an approach or a system (Morse et al., 2000;Zhu et al., 2016). The "Who" question ("who will benefit from the approach?") ...Â The purpose of this paper is to exploit existing initiatives in this field to help designers improve their BP models. Design/methodology/approach: This paper draws up a systematic inventory of the existing approaches to improve the quality of BP models.Â Our design allows data from a variety of sources to be combined to generate detailed information on traffic flow and journey times along the national road network.