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National information infrastructure: A cross-country comparison

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1. Introduction

This paper is a synthesis and analysis of five papers published in *Information Infrastructure and Policy* on the national information infrastructure (NII) in five countries: France, Korea, Japan, Singapore and the United States. Systematic comparison is facilitated by the fact that each of the papers was developed with a common conceptual framework and outline, and by a full day meeting among all the authors in an effort to distill similarities and differences in the NII of the five countries. The important similarities and differences can be seen by comparison on seven key dimensions:

Motivations

Visions

Strategy and policy design

Institutions and coordination

Implementation plans

NII services

Realities and prospects

Table 1 is a summary sketch of each country on the comparison dimensions, each of which is discussed next. The analysis shows remarkable similarity among country motivations and visions, but distinct differences on all of the other five dimensions.

2. Motivations

The fundamental motivation for the NII in the countries studied is economic, and might be presented in each country's official reports, public discussion and rhetoric as economic

opportunity for domestic industry, the threat of economic imperialism from large foreign firms, or both. Regardless of which of these views characterizes a particular country, all countries view the NII as a practical inevitability which must be addressed for national advantage.

2.1. Economic opportunity

The NII is generally presented as a technological and social vision of the information society of the twenty first century with economic considerations in the background. However, economic motivations dominate NII movements in the five countries and in all others as well (c.f. case studies of Germany, Canada, Brazil, India and Great Britain), which explains why so many countries are mobilizing around the NII. The key economic agenda is domestic jobs and global competitiveness. It is commonly felt that new information technologies will create vast new markets at home and abroad that can be captured by existing and new firms if the country is among the first movers in the information revolution. Competitive advantage is created for the first movers because they are able to set technology standards, get to market faster with the latest systems and applications, and exploit the biggest, richest markets around the world.

To emphasize the economic opportunity, various countries have produced estimates of the revenues and jobs that will be created. Japan's Ministry of Posts and Telecommunications forecasted 56 trillion yen (\$560 billion) in revenues from new applications and 2.4 million new jobs by the year 2010, while Korea's National Computerization Agency replicates Japan with a forecast of 100 trillion won (\$125 billion) in revenues and 560,000 in jobs by the year 2015. The President's Council of Economic Advisors estimated a \$100 billion boost and 500,000 new jobs to the economy by 1996 as a result of speeding up the deployment of the NII through telecommunications reform proposed by the Clinton Administration in 1994, while the Computer Systems Policy Project estimated the NII would create \$300 billion annually in new sales across

a range of industries. According to the Breton report, the French market for teleservices would be worth 90 to 190 billion French francs (\$18 to \$38 billion) in 2005. The report also projected that on-line information services could grow up to 16% a year in France over the next decade, while related employment would grow from 65,000 persons currently to at least 170,000.

In most cases, these foregoing numbers appear to be wild guesses and are included in official reports as though they were facts without any explanation of how they are determined. They are used as devices for mobilizing political and social support by showing the size of both the domestic opportunity and the foreign threat. Interestingly, there has been no debate about the numbers in any of the countries that have produced them, illustrating the irony that “bad numbers can make good politics.”

2.2. Threat of economic imperialism

While all view the NII as bringing opportunities for domestic firms, some view NII movements in other countries as a threat to their domestic industries. The threat ranges from concerns about economic imperialism to destruction of domestic culture. The threat of economic imperialism involves concern that ranges from fear that foreign firms will steal one of their markets, to fear they will steal the entire domestic market, to fear that the country as a whole will miss out on the information revolution which they view as important as the industrial revolution to the country's future. The latter concern centers around the notion that countries that did not take part in the industrial revolution until the first half of the twentieth century have been permanently disadvantaged or have only begun to catch up as more advanced countries are already moving on to the next major economic revolution.

One of the problems with the continual use of external threats as a device for mobilizing public and political support is that it is exhausting to civil society, potentially undermining of

public confidence in government institutions, and unnecessarily self-limiting. The Japan case illustrates the classic use of external threat as a mobilizing device for the NII, and further indicates that this is a historical tradition in Japan going back at least to the Meiji era and the threat posed by Commodore Perry's black ships. This strategy is self limiting because it is an effort to sustain an on-going crisis and emergency situation by focus on threats from real or imagined competitors (as was done by the United States and the Soviet Union during the 45 year cold war) rather than focus on the opportunities available with the new technologies and applications.

Whether viewed as opportunity or threat, the country cases clearly illustrate that major institutional players in all countries are convinced that NII is going to happen. In fact, many view the NII as a "train leaving the station" and urge that the country get on board before it is too late.

3. Visions

This bill will unleash enormous quantities of investment in every aspect of communications and computing. It's a bipartisan victory...[that will lead to] a technological revolution that will empower American families.

These words of Vice President Al Gore were pronounced on February 1, 1996 the day that the U.S. Congress passed a bill overhauling the nation's communications laws. The vision of the future NII embodied in Gore's words is fairly common across the five countries. The vision is that of broadband communications that are interoperable as though a single network, easily accessible and widely distributed to all groups within society bringing business, education, government services directly to households and facilitating peer to peer communication throughout society. In short, vision is a future information society enabled by modern information and communication technologies that will provide vast opportunities for new economic activity and a better way of life for everyone.

At this general level, the social visions appear aimed largely at mobilizing public and political support to create an NII movement that will reform telecommunications and launch new technologies, applications and use. However, the social visions also have unique local content in each country. Korea is concerned that the NII increase "transparency" in civil society. Singapore seeks a balance between the openness possible through modern communications technology and its "communitarian ideology." France desires to preserve and promote its "culture" while limiting the invasion of foreign cultures which the new media permits. Japan envisions a multimedia "information society" And the United States' information superhighway is aimed at "empowering" American families through providing them with choice from a wide array of information, services and entertainment to be available in the new information society.

This unique local content is an important part of the NII movement in each country because it appeals to basic social values in each society thereby differentiating and giving special meaning to country efforts.

4. Strategy and policy design

The NII plans in Japan and the United States are national plans aimed at national goals. For the most part, they are not influenced by outside considerations. In contrast, the NII plans of Singapore, France and Korea are all strongly influenced by outside considerations. Singapore's plan is aimed at maintaining its position as a business hub in the Asia-Pacific region and achieving the status of developed nations. France's plan is influenced by decisions of the European Union and by its desire to be a first mover within Europe in liberalization of telecommunications so that domestic firms are well positioned for the coming competition. Korea's plan is influenced by its desire for membership among the advanced nations of the world and for leadership in the Asian sphere.

4.1. First mover strategy

Although not directly stated in official documents on NII, it appears understood by most countries that the first movers in building NII will have a comparative advantage with respect to gaining the expected economic opportunities. This is because the first movers who innovate with the new technology have early access to the new markets for the technology. In addition, the first movers sometimes set the *de facto* standards that others have to follow, which provides them with additional competitive advantage from technical leadership. Japan and the United States are viewed by the other countries in the study as the two key countries that will compete head to head for leadership in the new technologies and new services.

However, as discussed below, it is not clear who will be the first mover in standard-setting. While many standards in the computer industry are *de facto*, government or industry collaboration in any of the three major markets (Europe, Japan or the United States), or especially between any two of these markets, could set standards for their own NII that would

become standards for the others, or at least have to be dealt with by the others in order to sell in these major markets. There is strong incentive among the innovators to postpone standard setting so they can reap the benefits of innovating before others enter the market, whereas there is equally strong incentive among fast followers to get standards set early so they too can make the new technologies and use them.

4.2. Fast follower strategy

Countries which feel they cannot be leaders in NII, such as Korea and Singapore, nevertheless feel that they can be fast followers, following close behind the first movers and gaining advantage relative to other countries that are slow to recognize or seize the opportunity. Singapore has consistently adopted new telecommunications and transportation technologies as an explicit strategy to gain advantage in attracting multinational firms relative to much larger countries in its region such as Malaysia, Thailand, Indonesia, Vietnam and China. It views NII as a means of reinforcing its ambition to become a business center not only for multinationals operating in the Asian region but also for other country's domestic firms who do business with the multinationals.

4.3. Competition strategy

Competition in telecommunications is another strategy envisaged in NII plans of the five countries, although to differing degrees. Free market competition in information and communications services is viewed as a key strategy for achieving the NII on the grounds that competition will stimulate innovation and speed up deployment. Thus, a key element of NII plans is liberalization of telecommunications allowing domestic telephone, cable, and TV providers to enter each others markets, cross media ownership and entry of foreign competitors

into domestic markets. The liberalization strategy assumes that free competition among a large number of suppliers who differentiate themselves in terms of products and services will emerge.

It appears that Japan and Korea will liberalize very slowly, leaving their existing monopolies more or less intact with the vast majority of the domestic market even though allowing new entrants to appear. It also appears from developments in the United States and France that the public and private monopolies that existed before liberalization might be replaced by oligopolies involving a few telecommunications and media giants that control production and distribution, or content and conduit. In the United States, these giants will emerge from a competitive free for all between companies grouped in various strategic alliances.

In Singapore, the government has encouraged liberalization and increasing competition, but in a controlled manner. For example, the structure of competition in internet service provision has been decided by government allocation of licenses to three large domestic firms. The first was given to the recently privatized but still government controlled Singapore Telecoms. The second was given to Sembawang Corporation by transfer of a government developed scientific network. The third was given to Singapore Press Holdings as the outcome of competitive tender. The only foreign competitor, AT&T, lost out even though it had the lowest bid.

These developments suggest that the recent round of liberalization efforts will require future government action to ensure real competition in domestic markets and to allow foreign competition into domestic markets as required by evolving international agreements on tariffs and trade.

4.4. Standard setting strategy

Country plans assume that the big players and big markets will create the initial technologies and set technology standards. Some countries such as Japan might prefer that technology standards be set by international standards organizations such as the International Standards Organization, but also recognize that standards are more likely to evolve *de facto* from industry leaders or from negotiation and consensus among industry players. Consequently, Japan's strategy is to be a key player in the United States and Europe—the two leading markets in the world in addition to Japan itself. The strategy of France is closely linked with that of the European Union (EU). While any single EU country such as France might not be able to set standards, the EU could be a first mover in standard setting because its markets are large enough to compel others to follow. Moreover, Europe has set its own standards in the past as illustrated PAL for TV sets and video recorders, GSM for analogue cellular and TDMA for digital cellular. The strategy of small countries such as Singapore, and countries that are not major players such as Korea, is to wait until the standards become clear before settling on their technology direction, while also trying to make substantial contributions to international standards development that would be of benefit to their country.

This wait-and-see approach is sound strategy because countries need to be consistent and compatible with the *de facto* standards set by the larger players and markets in order to ensure connectivity and interoperability at a global level and to be able to export NII products and services they might develop. The Singapore case illustrates that this nation state has been very explicit about monitoring technology standards, waiting to adopt until the standards are clear, and adopting *de facto* or international standards as they appear (e.g., the TCP/IP standard for the Internet and ATM technology for broadband communications).

4.5. Policy design for NII

The foregoing strategies (and others as well) might be embedded in an explicit policy design for the NII or the design might be left to evolve. Thus, a key problem in NII development is how to develop a policy design for the NII. Policy design means the establishment of institutions and/or specific policies and plans that will shape the evolution of the NII. The five country cases detail the institutions, policies and plans being followed in each country and present important differences. Singapore illustrates an explicit case of policy design in the establishment of a new institutional framework as well as specific policies and plans for NII development. In contrast, the United States illustrates a case of “order without design” through a dramatic shift from government leadership to market institutions.

The Singapore case suggests that policy design appears more feasible in small, concentrated states with centralized public institutions that can exert coherent influence over the private sector. This is because NII policy design requires significant institutional coordination which may be easier to achieve in small states with relatively centralized power. This Singapore’s National Computer Board was the institution traditionally charged with promoting computerization in the city state; after successfully computerizing government agencies and launching government-private systems such as TradeNet, and promoting computerization throughout the country, the NCB formulated the IT 2000 Plan which set out a broad vision for the integration of computers, communications and content and set out to realize the vision. However, it was soon recognized that other government ministries with roles in communications and broadcasting need to be involved and given strong roles. The Committee on National Computerization, which had launched Singapore’s IT plans and the NCB in the 1980’s was reconstituted as the National Information Technology Council with these major players as participants with the result that the roles of major participants were sorted out and the NCB

reengineered to fit into the new role structure. What also emerged was a decision to create domestic communications companies that could compete with big MNCs both domestically and abroad, be strong enough to forge alliances with MNCs, or both, rather than be overrun by foreign competitors. So, the telecoms authority licensed three ISPs which were all domestic enterprises already in the communications sector: Singapore Telecom, Singapore Press Holdings, and Sembawang. For domestic political reasons, it adopted a two wire to the home policy, while for global interoperability reasons, it adopted emerging technology standards for internet and broadband communications.

Policy design for Korea's Information Infrastructure (KII) has been characterized by strong central government leadership as indicated by the KII Plan. Planning for national projects has been a tradition of Korea as was seen in Five-Year Economic Development Plans and NBIS Plans, each of which were implemented under the leadership of the Economic Planning Board and National Computerization Board, respectively. A new steering committee headed by the Prime Minister, and attended by related Ministers was established to spearhead the KII Plan.

In contrast to Singapore and Korea, there is no policy design in the United States but there is a new order nevertheless—free market competition in telecommunications and the media. France too has rejected government-led *grande projets* in the tradition of Colbertism and turned instead to deregulation of telecommunications to promote market competition. Japan is engaged in a power struggle between powerful ministries aligned with various private corporations that have competing visions of the institutional framework under which the NII should be developed.

5. Institutions and coordination

5.1. Markets versus hierarchies

The NII is bringing about changes in the institutions used to achieve coordination in the information industries. In telecommunications and the broadcast media, coordination of public and private monopolies traditionally has been achieved through regulation by government bureaucracies (hierarchies). Monopolies were permitted to exist in order to achieve the economies of scale needed for investment and expansion of networks and services. The current round of liberalization in telecommunications and the media is recognition that technology has changed the economics and therefore governments are separating the regulatory and operations functions of government PTTs, setting up regulation as a government function but privatizing operations, and bringing in other providers to compete with the former monopolies. It is believed that competition will result in reduced prices, upgraded technologies and, once again, expanded networks and services. It is also assumed that free market competition will provide all the coordination that is needed and prevent monopolies from developing.

In computing and on-line services, coordination has been achieved largely through the free market with only occasional government intervention. In Japan, MITI, MPT, MOF and NTT coordinated R&D, investment and procurement to develop a domestic computer industry. In the U.S., the industry was developed mainly by private sector procurements, but military and civilian agencies supported R&D and engaged in steady computer procurements thereby helping to create the strongest computer industry in the world. However, the Justice Department regulated IBM for over twenty years to break its monopoly power domestically. In France, the central government supported its national champion, Groupe Bull, through procurements and subsidies. However, the PC era of computing has been relatively free of government attempts to coordinate development of the industry in the five countries in this study.

Actual liberalization has been much less than the rhetoric would suggest. In Japan, the MPT has encouraged new common carriers to enter telecommunications, but NTT continues to dominate with over 80% of the domestic market, thus leading to recent MPT proposals to breakup NTT to encourage further competition. Although Singapore claims to be market driven, the country case shows that the government still exerts considerable influence. The Singapore Telecommunications Authority has privatized Singapore Telecoms and given licenses to three internet service providers (including Singapore Telecoms) that are still state-owned enterprises (around 50%). The government seeks to create capacity and to be ready for demand; it seeks to build demand first through multinationals and regional business and then through households; it seeks to train up people, bring in media content multinationals to train up local staff and develop local capabilities; and it seeks to build strong domestic enterprises that can compete with multinational giants. In short, the Singapore government remains very much in the driver's seat.

While the POTS market in Korea changed from the Korea Telecom (KT) monopoly to the duopoly of KT and Dacom, the process of privatizing KT has been very slow. The Economic Planning Board's 1987 plan for privatization of public corporations (including KT) called for the government to hold only 51% of KT ownership by 1992. However, no KT stock had been sold by that time, and only a small fraction of the government's ownership was sold in 1993 and 1994. Thus, Korea has yet to really liberalize its telecommunications whereas France and the United States have recently taken big steps that are real by any measure.

5.2. Back to the future

There are strong elements of "back to the future" in the NII developments in all the countries studied. By back to the future, we refer to the tendency of countries to revert to earlier technological efforts and institutional regimes in their NII efforts. On the technology side,

countries try to build upon and to succeed with new plans in areas where they might have failed before. This is seen clearly Japan case where current NII trials essentially attempt to improve upon earlier failed experiments with new media communities and teletopias in the mid-eighties; these experiments in turn sought to improve upon earlier trials with video on demand in the mid-seventies.

Beyond repetition of earlier technology trials, and much more significant, is the institutional aspect of the back to the future phenomena. NII developments are shaped by existing institutions in the information and communications sector and by the institutional rivalries that characterize the major actors. These institutions include government agencies for telecommunications regulation, industrial policy and telecoms provision as well as private corporations in the computer, communications and content industries. Rivalries among these players can be major stumbling blocks to developing policy and implementing the NII. Even if focused only among government agencies, they send poor signals to the private sector in that warring government agencies may not generate their own demand or stimulate public demand for private services. If the government rivalries engulf the private sector, they may tie up private innovation and investment. The result in either case is decreased social efficiency if not the killing of private investment.

Although institutional rivalry is present in all of the countries, it is most apparent in Japan in the continuing competition between MITI, MPT and NTT and in the alignment of various public and private forces with these rivals. The effect is bureaucratic and policy gridlock which greatly slows down development. In the United States, the gridlock was centered in the Congress and the President, and in the competing telecoms providers such as AT&T, the regional Bell operating companies and the cable television industry, and together these institutions

prevented basic overhaul of communications legislation for two years after its initial introduction in January 1994. Rivalry between the Ministry of Information and Communications (MIC) and the Ministry of Trade, Industry and Energy in Korea seems to have been settled with the ascendance of the MIC to dominance in the computer and communications arena. Singapore was particularly effective in foreseeing the potential for institutional rivalries between its computer, information and communications agencies and acting quickly to restructure its coordination mechanisms to avoid them.

6. Implementation Plans

6.1. Technologies and timing

All countries' implementation plans call for broadband communications capable of two-way voice, data and video communications connecting businesses and households. Most assume fiber optic communications in a single network or a network of networks to the building and the block if not to the household itself. The plans generally call for the technology to be in place in 10 to 20 years for major urban areas if not countrywide. Only France has a 20-40 year horizon, which seems to reflect a lower export orientation, the need to fit in with European Union plans, the difficulty of privatizing France Telecoms, and the desire to protect French culture by moving slowly on the road to the information society.

Most country's plans call for speeding up implementation of the NII in order to achieve the economic benefits faster. As mechanisms to speed up implementation, country plans call for stimulus spending, government use, promotion of societal applications and telecommunications reform. However, as will be discussed more fully below in "Realities", many countries and particularly the information service providers, both public and private, have recently scaled back

their ambitions regarding the technologies, timing and role of government since the earliest plans appeared in 1993.

6.2. Models for NII development

Country plans call for private sector implementation of the NII. However, the country studies illustrate that NII plans and discussions do not seriously engage the question of models for NII development as a matter of public policy concern. They assume that appropriate models will emanate from private competition and that users will have wide choice. The Internet and the world wide web have turned around the idea of distribution from the providers to the users, to that of user-to-user distribution; yet this is not the model usually found in private sector plans. The model of NII in existing commercial ventures, mergers and acquisitions and evolving strategic alliances is that of interactive TV and commercial on-line services such as Prodigy, America Online and CompuServe. These are “gateway” models which posit control over content and its distribution to the service providers who bundle content and distribute it through their own conduit. In contrast, the “common carrier” or “peer to peer” model illustrated by the Internet in the United States and Minitel in France is seldom put forth as a model of how commercial information services will be provided. The failure to set forth preferred models, or to ensure that at least these two basic models exist, might lead to frustration of economic and social goals.

The prospect that this might happen is heightened by promoters of liberalization. As illustrated by private debates in the United States between Gilder, Toffler and Gingrich on the one hand and Daniel Burstein on the other, the promoters of liberalization as an NII strategy make the happy assumption that free competition will invariably lead to the common carrier model. Even if oligopoly should develop, they argue that it will be undone by the next wave of

technological innovation. The problem with these happy assumptions is that major technological innovations are likely to occur in fifty year rather than five or ten year cycles thereby frustrating both consumer interests and the broader public interest in open, easy access to the NII.

7. NII services

7.1. NII services and user needs

Who is going to use the NII? It is clear that businesses and professionals are going to be the first users of the NII because they have the clearest need and the money to pay for the last mile. Japan already has wire to the building in central Tokyo and other major cities, and Singapore and Hong Kong also have wire to the building in their small, dense city states. The last mile to the home is telephone and/or cable in all five countries. All of the NII visions assume there is a need for a high speed, high bandwidth wire into and out of households. In fact, the need for high bandwidth is only into the home in order to receive high quality images, large databases, etc. that can be downloaded to PCs or other information appliances. This same need does not exist at the output side because the speed of inputting data at the household level is essentially limited by typing speed and dealt with adequately by existing telephone lines. Moreover, there might not be a need for any kind of wire to the household in the future. Cellular, low orbiting satellites and video techniques might allow speeds and bandwidth needed for fast, quality reception.

8. Realities and prospects

8.1. Implementation slowdown

The initial euphoria and rosy forecasts for NII implementation are giving way to a host of realities which have the net effect of slowing down implementation. Technology is a key factor in the slowdown everywhere and has two very different aspects. The first is continual change in

the technology which makes available new options not possible before. This is illustrated by current thinking that wireless technology supported by low orbiting satellites might provide high quality broadband communications thereby eliminating the need for the very expensive last mile wire to the home and wire-based services to rural and remote areas. It is also indicated by the current realization that high bandwidth might be needed coming into the home in order to quickly download high quality video and broadcast images, but that existing wires might be adequate for communications coming out of the home.

The second technology aspect affecting the slowdown in implementation is disappointment with the results of technology trials which raise serious questions about user interest and willingness to pay for the new services envisaged early on. These disappointments are causing some information service providers to scale down, drop, or radically change their early implementation plans. In the United States, for example, AT&T and the seven regional Bell operating companies surprised federal officials in January when they opted not to participate in the auction for a new satellite TV service. AT&T chose a more modest route of investing in an existing satellite TV service. Similarly, the regional Bells have grown cool to the idea of providing video to consumers other than through a traditional cable TV system. As put by one observer, "more deals seem to be unraveling than coming together."

8.2. Benefits and costs of NII

The country cases all illustrate that the major players in NII development assume that the benefits of NII will be positive, immediate and direct if one is an early adopter and the consequences will be dire if one fails to adopt. There is a bit of hysteria about the claims for and threats of NII which appears intended to mobilize domestic political support for policy and action. This hysteria is seen most directly in the case of Japan, but it is present in the other

country case studies too. The United States particularly is posed as a giant competitive threat despoiling others' domestic industries and culture if the countries do not "get on board the NII train which is leaving the station". The premises underlying the benefits and threats are not seriously assessed in any of the NII studies, policy statements, or discussions. They are not examined either in terms of past experience or current developments.

In contrast to the rhetoric, prior research and the evolving experience with NII trials and demonstrations indicate that NII effects are likely to be a complex mix of positive and negative outcomes, require a long time to be felt and occur indirectly. One example is the economic and employment benefits. Japan and Korea both claim extraordinary revenues and jobs from the NII but do not substantiate these claims with serious analyses. The United States estimates the incremental benefits of large government spending aimed at speeding up private development of the NII without considering opportunity costs.

Another example is network externalities. It is clear that the greatest benefits of NII will occur when the vast majority of business and household users are interconnected. However, realistic estimates place this at 20-40 years in the future rather than the five to fifteen years assumed by the various countries as illustrated in the case studies. In the short term, benefits will accrue primarily to large businesses, professional users and wealthy, educated households because they will be best equipped to use and pay for NII services. Small businesses, remote areas, inexperienced users, poor households and even the majority of households will be left out of the more advanced systems and applications unless major technological breakthroughs should develop that are now unforeseen. In short, the rhetoric of benefits and costs are not seriously examined and are generally unrealistic.

9. Conclusions

There are several conclusions that can be drawn from the foregoing the cross-country analysis of five countries that have implications for other countries. First, as is the case for each of the other countries in the study, each country is unique and must develop its NII with regard to its own circumstances and values. Although many features of a country's NII might be similar to the NII plans and experiences of other countries, they will almost always be different in their actual implementation and details in the host country. This is as it should be.

Second, it behooves other countries to continue to watch NII developments in other countries, but especially in the United States, Japan and Europe. These are the three largest markets in the world, and what they do will shape the future NII developments elsewhere. While Asia might become a unified market sometime in the future, such a prospect is longer term rather than intermediate and probably cannot be a serious consideration in NII plans at this time.

Third, the other countries in this study tend to see the United States as the leader in creating or innovating with technology, but they see Japan having the manufacturing capability to compete strongly once the direction of new technology becomes clear. Europe is seen less as a leader in technology than a possible leader in standard-setting. Thus, different developments bear watching in the different leading markets.

Fourth, other countries can benefit from looking more closely at Singapore's strategy and plans. For example, Singapore's NII is explicitly intended to strengthen the country's regional business hub role, particularly within the Southeast Asian region. Hong Kong and Taiwan are vying for similar roles in the South China Sea region. Will such regional hubs emerge in other parts of the world? How feasible is this goal for Korea? Does Korea now play roles within the region that the KII can reinforce? Or, is Korea trying to use KII to become a force in the region?

The latter aim might be too ambitious if Korea does not already play a significant regional business hub role.

Fifth, countries probably need to clarify for themselves the primary goals and strategy of their NII initiative, and to ensure that government and industry are moving in the same direction so that their efforts are synergistic and mutually reinforcing rather than in conflict and mutually defeating. For example, the Korea case study suggests that industry is moving in close relationship with government, but it does not indicate whether industry and government are moving in the same direction. Now might be a good time for Korean government and industry leaders to consider this question because the KII initiative is very young and the country is about to embark on the next Five Year Plan for the NBIS Project.

Finally, as indicated in the cross-country comparison, it is going to take longer than expected for NII visions to be realized and the future reality will probably look different than anyone imagines today. This is indicated by the fact that the initial euphoria and rosy forecasts for NII are giving way to a host of realities which have the net effect of slowing down implementation.

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Table 1. Summary of cross-country comparison

Countries	France	Japan	Korea	Singapore	United States
Motivations	New economic growth and jobs; reaction to perceived U.S. threat; fit telecoms reform agenda set by European Union.	New economic growth and jobs; reaction to perceived U.S. threat; catch-up with U.S. lead in PCs, software and networking.	Desire for early participation in information revolution; reaction to perceived U.S. and Japanese threat; competition for Asian leadership.	New economic growth and jobs; compete in region; attract MNCs; reinforce role as business hub.	New economic growth and jobs; compete globally; maintain lead in computers, communications and media.
Vision	Preserve French culture.	Multimedia information society.	Establish status among economic powers; provide transparency in government.	Intelligent island; achieve balance between openness and communitarian ideology.	Information superhighway; empowerment of citizens.
Strategy and policy	Be a player in the industry through free market competition; be first mover among members of European Union.	Catch-up with the U.S. through stimulus spending, domestic trials, and participation in foreign trials.	Government to be leading NII user and to stimulate public demand; expand private sector role in NII and stimulate private investment.	Adopt features of free markets but keep government as driver; be a fast follower of advanced nations but a first mover in the region.	Maintain lead through free market competition to stimulate investment and innovation; “order without design” through markets versus hierarchies.
Technology and Timing	Fibre optic backbone to block with copper wire to household by 2015.	Fibre optic broadband network to the home by 2005.	Fibre optic broadband network to the home by 2015.	Fibre optic broadband to the office and residential block; coaxial cables to all homes by 1997; two-wires to each household by 2005.	Fibre optic broadband network to the home by 2015; last mile being reconsidered for copper wire (phone and CATV) and wireless.

Table 1. Summary of cross-country comparison (continued)

Countries	France	Japan	Korea	Singapore	United States
Institutions and Coordination	Ministry of Industry, Posts & Telecoms is coordinator at country level; Directorates in European Commission influence country decisions.	MPT, MITI, MOF in government and NTT plus NCCs in industry. MPT and MITI in competition; no overall coordinator except perhaps MOF.	Ministry of Information and Communication is government coordinator.	NITC, TAS, SBA, STel, Ministry of Information and Arts, SIM, SCV, new ISPs, NCB. Coordination by government, especially NITC.	Congress, FCC, NIST, State PUCs. Coordination by the market. Government is the court of appeal.
Implementa-tion plans (Telecommuni-cations and media ownership, computing networks)	Liberalize telecoms; corporatize & privatize France Telecoms; allow new telecoms entrants; no <i>grande projets</i> .	Liberalize telecoms somewhat; NTT privatized and new common carriers created;	Promote market competition; Korea Telecoms (KT) monopoly changed to KT and Dacom duopoly. KT to be privatized, but only small fraction sold off in 1993 and 1994.	Promote competition in phone, cable, broadcast and computing networks; privatize STel; corporatize SBC as SIM; create SCV, early promotion of interest for cable; license new ISPs; deploy NCB applications on networks; use govt-linked enterprises for control.	Broadly liberalize telecoms. Long distance, local phone and CATV may enter each others markets; cross-media ownership permitted up to 35% of market.
Realities and prospects	France Telecoms unlikely to privatize; liberalization legislation is pending for 1996; if passed, government will be stepping out of major role; NII prospects will then depend largely on private sector in short term.	NII prospects depend upon resolution of gridlock over future of NTT; stimulus spending by government creating spurt in adoption of computers and internet.	Government is the driver; NII prospects depend upon slow moving liberalization and future funding for KII; role of private sector unclear but could be substantial.	Government is the driver; private sector will follow government lead; Singapore moving fast on implementation of shorter-term applications while investing in dual broadband conduits to the home to prepare for eventual NII deployment. Balance between communitarian & liberal values remains issue.	Communication legislation passed Feb. 1996. Funds cut for government trials; NII prospects depend largely on private sector in short term.