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# Analyzing the Role of the State in the Promotion of the Information Revolution

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**ANALYZING THE ROLE OF THE STATE IN THE PROMOTION OF THE INFORMATION REVOLUTION**

**by**

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**Under the Direction of Charles Hankla**

## ABSTRACT

This paper analyzes the relationship between effective state intervention and Information Communications Technology (ICT) dissemination. I theorize that investment in ICT leads to benefits for all firms; without government intervention and incentives, firms will have little reason to invest substantially in this arena. I demonstrate how the collective action problem leads to a lack of private investment as highlighted by the prisoner's dilemma game. I conduct a multi country regression test to ascertain the factors that influence the dissemination of IT. I then analyze the impact of the United States and South Korean government on ICT by process tracing the role of each government in the dissemination of ICT. My results support my hypothesis. The policy implications for this study are the increase in the level of US government involvement in ICT through encouraging private sector participation, creating new laws, and increasing access to technology in public education.

INDEX WORDS: State Directed Development, State Intervention, Information Communications Technology (ICT), ICT Infrastructure, Broadband Infrastructure, South Korea, United States, United States Infrastructure Problems

# ANALYZING THE ROLE OF THE STATE IN THE PROMOTION OF THE INFORMATION REVOLUTION

**by**

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Imagine a technologically advanced country where one can download a feature length movie on one's computer or cell phone in a matter of seconds. Think of a country where communication data travels at a speed of 20 megabits of data per second (Mbps) on both the home phone and the cell phone.[i] Imagine a country so technologically advanced that about 76 percent of households have broadband access and 75 percent have mobile phones.[ii] Imagine if you will a country where there is no location within its borders where one can stand without receiving a cell signal. If someone were asked to guess the name of this country, he or she would probably guess the United States - after all the United States was credited with the invention of the internet. Some would guess one of the nations within the European Union as they are a second most likely source considering their standing since the industrial revolution. However, unless familiar with the information technology industry, very few would guess that this country is South Korea.

Birgitta Forsberg's article states that South Koreans can get up to 20 megabits of data per second ("Mbps"), breakneck speed by today's standards, while Americans are lucky to get 4 Mbps (2005, 1). This is because South Korea leads the world in rollout of Broadband and Information and Communication Technologies (ICT) [iii]. To provide perspective on this ranking, it is important to note that the United States, supposedly the world's technology leader, comes in at 13th in the ICT arena according to Forsberg (2005, 2). ICT is the electronic means of capturing, processing, storing and disseminating information. A broader definition of ICT includes technologies such as radio and telephone, as well as newer innovations such as computers and personal digital assistants (PDA's), according to the World Bank Empowerment Sourcebook.[iv] Broadband, the name usually applied to the internet infrastructure, is a transmission facility having a bandwidth sufficient to carry multiple voice, video or data

channels simultaneously. Broadband can be associated with not only computers, but also cable, television and wireless phones.

Because of its advancement in broadband infrastructure, the progress of South Korea in the area of information communication is not limited to computers. Wireless phones, one of South Korea's largest industries, have a penetration rate of 75 percent in South Korea compared to 60 percent in America (Forsberg 2005, 1). And while there is no place in Korea that one can stand without receiving a wireless signal, the United States is still in the "can you hear me now" stage. With this information coming to light, technology leaders in the United States are expressing their concern that the nation is falling dangerously behind in broad areas of technological and digital innovation.[v]

My thesis will examine the reasons why the United States is not the technology leader in broadband and digital information communication when the United States Department of Defense was the pioneer of the internet and the innovator of the information era.[vi] What did South Korea do differently that propelled it to become the world leader in the area of information communication technological innovation? My thesis will analyze the role government played in the development and growth of the information communication arena for the top countries in ICT in order to better understand why the United States is not in the top 10 list for information communication measurement, and suggest ways in which the United States government can promote ICT development. Ultimately, the point of the research is to understand how this small but emerging country of South Korea can outpace the United States in the race for the development of an information society.

In this paper I argue for a relationship between effective state intervention and ICT dissemination. The paper starts with a literature review which discusses what is already known

about the government's role in industrializing a nation. I also review when and why some states are successful in the promotion of economic and industrial growth within a country. I then develop my theory, showing that without government intervention and incentives, firms will have little reason to invest substantially in ICT; but with investment in this arena can lead to benefits that can be enjoyed by all firms. I demonstrate how the collective action problem leads to a lack of private investments as highlighted by the prisoner's dilemma game. In sum, since ICT investment represents a public goods problem, state intervention is necessary for optimal outcomes.

This theory leads me to two hypotheses in the fourth section. I argue that countries that prioritize ICT and utilize an effective state directed approach to ICT dissemination have a higher rate of ICT consumption and are more technologically advanced than those who do not. Subsequently, I argue that the low level of public investment in the United States impeded the growth of its ICT industry. In the fifth section, I discuss my methods for testing these hypotheses in two tests. In my sixth section, I present the results of my empirical analyses. In my quantitative analysis, I analyze the basic relationship between state participation in the promotion of ICT and its impact increased IT consumption rates. In my second test I analyze the impacts of state-directed intervention on the creation of an information society in the United States and South Korea through process tracing. In tracing the actions of each government I hope to tie their actions to each country's dissemination of information communication results.

**LITERATURE REVIEW**

In order to begin to understand why South Korea, a developing nation in the 1980's and the 1990's, was able to advance past not only the United States, but also other industrialized nations in the race for ICT dominance, it is necessary to look at the literature regarding each

country's approach to industrialization and informatization. There are marked differences between the approaches of United States and Korea to the dissemination of the internet and other communication technologies. The difference is most evident is in the development of the broadband infrastructure.

Broadband is the new access technology which uses upgraded elements of infrastructures initially built for telephony. In the case of telecommunication networks, the primary development has been the deployment of digital subscriber lines (DSL)[vii]. It also includes other technology like cable modem access which is enabled by networks which have been upgraded from their original purpose of providing cable television. The definition also encompasses terrestrial fixed wireless and cellular mobile platforms which are also capable of providing broadband access.[viii]

Universal Mobile Telecommunications System (UMTS) is the cellular services used for 'second generation' mobile networks to 'third generation' (3G) mobile technologies. Additionally UMTS is used for fixed wireless access platforms to provide broadband access within a local area through WiFi or over a wider area through Wimax and Mesh Wireless Networks[ix]. The creations and expansion of a broadband infrastructure allows the new technologies to use circuit switched and alternative networks instead of the public switched telephone network (PSTN) originally used by the early telephone systems.[x] The complexity of this new technology is identified in the number of different alternative networks used for a single task. For instance, a satellite or power line might be used to provide a connection to a location, with local access provided with WiFi. As a result of these developments, services are no longer tied to specific platforms. On the whole, this collection of access technologies is generally

referred to as broadband or high speed internet access. Without broadband infrastructure, growth and dissemination of the internet is impossible.

A country's success in creating and expanding the broadband infrastructure seems to depend on the government view and participation in the development and promotion of the information infrastructure. Much of the research shows that early in the privatization of the internet the United States adopted a "pro market" approach to dissemination, while South Korea chose a "hands-on" approach to the dissemination. The pro-market or free market position is often spoken of at varying level of sophistication, from popular media to policy advocacy to scholarly theoretical and econometric studies. For the purposes of this thesis, we will define the free market approach as when the role of the government is kept to a minimum allowing an industry and an economy to develop unfettered. It is believed that if the government abstains from interference and the market forces are allowed to work unrestrained, then there will be more economic growth and product dissemination. On the other hand, the countries that exhibited explosive growth in the industry and successful infrastructure development, like South Korea, seem to have had concentrated state involvement and direction. State involvement in and of itself is not necessarily the best indicator of successful ICT dissemination. When reviewing the literature on industrialization and informatization it seems that the type of state involvement, not the amount of involvement, might be the best predictor as to why one country exploded in the growth of information communication technologies and why other early industrialized countries progressed at a much slower pace.

The primary argument to explain why some countries advance quicker than other is the type of state involvement in the industry and the role of the state in promoting the industry. Peter Evans and Atul Kohli both suggest that there are certain types of state involvement that can

lead to industrial transformation of a nation. Kohli suggests that the deeper reasons for why state intervention succeeds or fails have to do with political principles and ideological purpose behind the structure of the state (Kohli 2004, 420). In order to increase the economic development of an industry the state must have a plan to and be empowered to direct the rate and the efficiency of any investment. Evans explores three countries and their different types of governments and different approaches to state involvement in order to explain why some countries succeeded in industrialization while others were unsuccessful in the information technology sector. The book suggests that there are two types of government, the first of which is predatory, meaning it "extracts at the expense of society, undercutting development even in the narrow sense of capital accumulation" (Evans 1995, 12). In the predatory states an atmosphere is created where incumbents pursue their own goals and individual maximization takes precedence over the pursuit of collective goals. As a result, the government feeds off the economy rather than pursuing the collective goal of its citizens. Therefore, this type of government is not very effective in the promotion of any industry.

The other type of government identified by Evans is the developmental state. The developmental state "not only presides over industrial transformation but can be plausibly argued to have played a role in making it happen" (Evans 1995, 12). This state is characterized by meritorious recruitment and long term career rewards in order to create commitment and a sense of corporate coherence. (Evans 1995, 12) The corporate coherence will give these types of states a certain amount of autonomy but the rewards program creates a positive connection between the firms and their government which he refers as embedded autonomy. This embedded autonomy results in states that are capable of resolving collective action problems and transcending individual interest of its private counterparts.

It is important to note that it is not just the type of state that can promote or stifle industrial development, but the role that the state takes on. Evans goes on to explain that there are four ways for a state to be involved. The first two roles, "custodian" and "demiurge", can be loosely categorized as a role of regulator and producer respectively. The second pair of roles are "midwifery", where the state assists in the creation of new entrepreneurial groups into more new areas of production and "husbandry", where the state assists the existing private entrepreneurial groups to promote growth within a particular industry (Evans 1995, 14). In other words, midwifery is when states help create new private firms and husbandry is when government assists existing firms within a particular industry. He goes on to explain that Korea has been successful in the promotion of ICT because it was not only a developmental state, but since it also combined the role of demiurge and husbandry to create an atmosphere of collective action. Evans concludes in his study that "it is not the type of state involvement per se that counts. More importantly, it is finding the combination of roles or strategies that fits the industry" (Evans 1995, 102).

One way to understand the degree of state intervention is to analyze the different approaches a state can take to promote successful industrial growth. Robert Wade explains that there are distinct reasons why the countries of East Asia, particularly Japan, Korea and Taiwan were able to advance in industrialization during the later part of the 20$^{th}$ century. He credits the Neo-Classical theory for late industrialization which identifies the proper role of the government as maintaining the economic stability, providing physical infrastructure, and providing public goods. Wade discusses how South Korea, for example, decided to use a combination of Free Market (FM) approach which allows the market to run free without much state intervention, and the Stimulated Free Market (SM) approach where active intervention from the state is aimed at

applying incentives that to achieve the government goal (1990, 23). In addition, South Korea used the Governed Market (GM) approach, a combination of very high levels of productive techniques into actual production, more investment in certain key industries than would have occurred in the absence of government intervention and exposure of many industries to international competition, in foreign markets if not at home (Wade 1990, 26).

It is the combination of these three approaches that Wade believes to have spurred the East Asian tigers toward economic success. The Korean government has gone through periods of time where they have actively orchestrated the activities of "private" firms. It also actively promoted exports and offset market failures (Wade 1990, 4). Market failure can be defined as a situation in which markets do not efficiently organize production or allocate goods and services to consumers in a ways often seen as economically efficient or socially or morally preferable or serve the public interest. Market failure can be avoided when government intervention stimulates ideal market conditions through national objectives, policy priorities, and government incentives. Wade argues that South Korea was successful because it also used national policies to promote industrial investment (1990, 350). Government involvement included through technology investments, tax incentives to increase the private firm's return on investment, and government coordination of public and private technology development activities (Wade 1990, 12). Wade ultimately argues that the role of government of those countries has gone well beyond the practice of Anglo-American economies which uses more of the free market approach and more increasingly the stimulated market approach (1990, 6).

There are other debates as to why South Korea may have been more successful in the dissemination of ICT than the United States that have nothing to do with the inherent problems of the free market approach. Chalmers Johnson and Alice H. Amsden both suggest that one such

reason could be that early industrialized countries are at a disadvantage in the dissemination of new technologies because of dependency on old technologies. It was not until the late 1980's that South Korea developed a reliable telecommunications infrastructure. However, once they began to build that infrastructure they were able to take advantage of the newest technologies available and build their telecommunications infrastructure much quicker and even develop a nation wide broadband infrastructure by the close of the 20th century. Many of the western industrialized societies were unable to take advantage of the newer technology because of the investment in older infrastructures that would have to be removed or altered in order to install the new telecommunications equipment. Other implications to upgrading the technology is disruptive to the workforce, the economy, and ultimately the firms and citizens that rely heavily upon it.

Johnson explains that another reason why late industrialization has the advantage is because of the changes in the role of government over the last century. He explains that "following the industrial revolution, the state began to take on new functions. In those states that were the first to industrialize, the state itself had little to do with the new forms of economic activity but towards the end of the nineteenth century the state took on regulatory function in the interests of maintaining competition, consumer protection and so forth" (Johnson 1982, 19). Those changes in the government were very effective in a market economy. Many of the early industrialized nations still manage their countries in the same fashion today. On the other hand, for late developing countries this sort of market approach was not the most advantageous and those countries that attempted late industrialization the market approach would not work. As a late developer private industry is at a disadvantage and state involvement is necessary due to inherent market failures. Late industrialized countries approach the role of directing governments

and the industry very differently. Countries like Japan and South Korea, along with the other Asian tigers, took a more developmental function as the state itself led the industrial drive. Their focus was more on determining which industries need to exist to succeed in the future, and assisting the private sector in bringing this about. Late industrializers' relationship between the public and private sector appears more like a marriage than the protective relationship between early industrializers and the private industry.

Johnson explains that these two differing approaches produced two distinctly different government-business relationships. For instance the United States government has many regulations concerning the antitrust implication of the size of the firm, but it does not currently concern itself with what industries ought to exist and what industries are no longer needed, while the developmental or planned rational state, by contrast, has as its dominant feature the setting of both social and economic goals for the national economy (Johnson 1982, 19). Unfortunately for western societies like the United States, early development resulted in their accepting a way of governing the nation's economy and development that propelled into the 20th century, but could impair them during the 21st century.

Alice H. Amsden echoes Johnson's argument regarding the advantages to late industrialization. She suggests that early industrialized nations worked to develop new products or processes, while late industrialized countries were able to borrow foreign technology rather than by generating new products or processes (Amsden 1989, V). The United States, like other early industrialized nations, captured the market through innovation. For example, the United States was successful in innovation in the world technological frontier winning forty of the sixty two Nobel prizes in the sciences between 1976 and 1985. But it was the United States ability to commercialize those inventions that made it the leader in the high technology markets (1989,

320). In addition, she concludes that South Korea was able to penetrate the world market because it leveraged the technology already developed, educated its workforce to use and improve the technology, and built an infrastructure to support the technology now and in the future. South Korea was able to accomplish the governmental influence on private large firms and penetrate the world market through a high degree of state intervention.

**THEORY**

With all of the debates as to why South Korea and the Five Asian Tigers have progressed so rapidly in the last couple of decades, no one has systematically tried to explain why the United States is not progressing in the area of ICT at the rate previously seen through the industrial era. I suspect that one of the main reasons the United States is not the industry leader in the ICT arena is because of the way it adopted and promoted the internet when it was first privatized. The United States viewed the internet as a "tool of commerce" and not a "tool of communication", and therefore decided to let market forces dictate ICT growth. This free-market approach was supposed to create an economic market in which ICT growth was dictated by the laws of supply and demand of the internet and related information technology tools. This approach did not allow government interference, regulation, or subsidies. Many of these government industries like telecommunications, cable, television, and radio were allowed to continue operating individually within the realm for which they were created even though the new communications required that they work together. The free market approach was seen as a critical element to the development of the IT infrastructure and supporting products and services. I argue the reason why the free-market approach has not been successful in ICT is because of the inherent market failures that exist when there is a public goods problem, lack of collective action, lack of

standardization, and the failure of interplay between the public communications sector and private information technology sector that are inevitable without state involvement.

**The Public Goods Problem**

Relying on free trade to disseminate the information communication technology may not work because the ICT industry is a prime candidate for market failure. Market failure is a situation in which markets do not efficiently organize production or allocate goods and services to consumers. For the purposes of this thesis, a market failure is where the benefits of the free market, such as the distribution of cheap high quality goods, fail to materialize. Economists argue that, for a market to work well, certain factors must be present. These factors include competition, information, certain public goods, absence of externalities, and a constant return to scale. This thesis focuses on market failures when there are certain public goods problems such as the absence of a common infrastructure. I develop this idea through my discussion of the collective action problems which exist when private actors are not motivated to invest in public goods, paticularly in a public good as expensive as the broadband infrastructure.

The public goods problem is one potential reason for market failures under the free market approach. Public goods are those goods and services that must be provided by the government because there is not incentive for the market or any single firm to provide them. Public goods are economic products that are consumed collectively, like highways, sanitation, schools, national defense, police and fire protection; they are non-excludable and non-rival in consumption.[xi] It is not in a nation's best interest to allow a market to dictate the provision of these essential tools or services required for the advancement of the nation. Elinor Ostrom argues that "the public goods problem occurs when one must rely on players and organizations taking responsibility in the public commons in order for an industry to grow" (1990, 14).

The development of the ICT infrastructure is an excellent example of this public goods problem. When it comes to investing in the information technology infrastructure where the infrastructure will be received by all, a firm in a perfectly competitive market only gets a small part of the benefit. Therefore firms may be less likely to make such a costly investment where they will be one of many benefactors, without some incentive or influence by the government. In those countries that have had above average dissemination of this public good, there were financial incentives provided by the government to aid firms in the investment and contribution.

With no incentive to cooperate, the firms needed to build this industry for the common good could fall into the classic Prisoner's Dilemma Game. In the prisoner's dilemma game, there are two players, each having the option to cooperate with the other for the common good or to defect from the common good. In the case of the ICT broadband infrastructure investment the problem occurs when each player is not certain that the other group will do their share of investment, even though both will benefit from the investment equally.

In the table below I show how we can arrive at the 4 potential outcomes. The outcomes are based on whether or not each player chooses to cooperate and whether or not each player defects. If a player is the sole provider of the public good but only receives the benefit equal to that of other player that did not contribute to the public good they receive a "0". A player will receive a "1" if it does not receive any benefit from the public good and does not provide the public good. The number "2" represents a player that has participated with others in providing the public good and receives the benefit of the public good. Finally, a player can receive a "3" if they do not provide the benefit of a public good but receive the benefit of usage when another player provides it.

**Figure 1: Prisoners Dilemma Game**

| | **Cooperate** | **Defect** |
|---|---|---|
| **Cooperate** | 2,2 | 0,3 |
| **Defect** | 3,0 | 1,1 |

The dominant strategy, in this case, would be for both players to wait for the other to invest in the infrastructure and participate in the benefits. The cooperative strategy will be for both players to invest in the infrastructure for equal amounts and share in the benefit equally. Ostrom explains that "if each chooses independently without the capacity to engage in a binding contract, each chooses his dominant strategy which is to defect" (1990, 4). When they both defect, no infrastructure is created and neither shares in the benefit, but neither absorbs the huge cost of the investment. In this game, each player has a dominant strategy in the sense that the player is always better off choosing the defect strategy, no matter what the other player chooses. When one player chooses to defect regardless of the other player's choice, the outcomes are considered Pareto-Inferior (Ostrom 1990, 5). Ostrom explains that a "Pareto-Optimal outcome occurs when there is no other outcome strictly preferred by at least one player that is at least as good for the others" (1990, 5). A Pareto-Optimal outcome occurs when both players choose to cooperate. Total cooperation is unlikely without either conversation, contractual agreement, or some sort of government incentive that puts cooperating more squarely in line with both players' interest and a less risky proposition. More importantly, this cooperation, even through contractual means, will not likely happen without some sort of enforcement, something that the state has the power to provide. This highlights that it is improbable for rational creatures or entities to cooperate without enforcement.

This supports Evans' theory that there are certain types of state intervention necessary to lead to industrial transformation. Without government incentives, investment, and direction, countries may have less success in promoting the diffusion of information communications technology. If a government relies solely on the free market approach and does not create an attractive environment for private investors; private firms may be more inclined to wait on another firm to make the costly infrastructure investment, since they will also be able to share in the benefits regardless of their contribution. As a result those countries that did not adopt internet technology as a common good "tool of communication", and provided no government assistance in the dissemination of the new technology, may not have experienced the full potential of market growth that this tool could offer.

This public goods issue is most apparent in IT where currently there is no cooperation to build the common infrastructure in the United States. In the information technology industry, it is expected that items such as broadband network infrastructure will increasingly serve as a venue for creating new applications, as current communication speed and content boundaries are expanded. Additionally, the research and development cost of exploring, testing and creating new software, hardware, and communication infrastructure technology is monumental. Building a broadband infrastructure, launching a satellite, or creating the multimedia requires enormous cost and man-hours for one firm, while the benefit can be used by virtually everyone. Unfortunately this begs the question of who will invest the up front cost, if those who do not invest will receive equal or close to equal benefit. It is imperative that companies that have the technical resource to invest in ICT innovation are encouraged to do so. It is unlikely; however, that a company will feel obligated to contribute without government prioritization, incentives, and investment.

Another issue that affects the promotion and growth of a common infrastructure for the US ICT infrastructure is the lack of standards. In the fast-paced environment of information technology, standards are critical to success in the marketplace. Standards are essential elements of information technology-hardware, software, and networks. According to the InterNational Committee for Information Technology Standards (INCITS), interfaces allow disparate devices and applications to communicate and work together.[xii] Standards can also fortify security and information privacy as they are critical to realizing many widespread benefits that advance in electronic and mobile commerce are anticipated to deliver. Infrastructure and electronic communication standards can help industry engineers, product managers, and company management evaluate the approaches available for standardization of their technology. The goal of the National Institute of Standards and Technology (NIST) is to create globally accepted and highly interoperable products.[xiii] Standardized hardware and software will enable ICT equipment to work with a common infrastructure. These standards can ultimately aid in the creation, management and support of a National Information Infrastructure (NII).

Another factor that affects the development of the new broadband infrastructure is the impact it has on the existing telecommunications infrastructure. As the new multi-media infrastructure is developed an increasing number of traditional telecommunications services will need to migrate to the broadband platforms. The impact on the telecommunication infrastructure, which is a staple in many developed nations today, will include not only abandonment of costly infrastructure, but loss of interdependent technology, and significant job loss. While larger telecommunications organizations that are entrenched in old technology face possible extinction, they will need government support and guidance to integrate their equipment and their employees to the new communications infrastructure. Without the participation of

these larger organizations, the growth of the infrastructure will remain stagnant. These firms need substantial financial incentives in order to come to terms with any plan to repurpose the abandoned physical infrastructure and manage the loss of jobs. A government that does not provide incentives through tax credits, grants, low cost loans and or employee training compensation risk stagnating its ICT growth and innovation.

In the case of the broadband dissemination, players voluntarily exiting the prisoner's dilemma and cooperating for the public's benefit in a free market environment are improbable. Mancur Olson explains that "it is often taken for granted, at least where economic objectives are involved, that groups of individuals with common interest usually attempt to further those common interests" (1968, 1). While a single individual will act on its behalf of his or her personal interest, this does not assume that groups of individuals with a common interest will act on behalf of the collective common interests. Even if all actors have a self interest in the same outcome, they will want another member of the group to pay to provide it. In other words, with no incentive for firms to work together or disseminate the information, the market alone will not have the ability to promote growth of the new technologies. Ned O'Brien of the Economic Bureau, State Department Office of International Communications and Information Policy, stated in his speech at the Broadband Communications Conference that "there are three key areas in which only the government can foster broadband growth and development: creating economic incentives, removing regulatory barriers, and promoting technological innovation to help make communication technology more affordable." (O'Brien 2005, 2) Without these key areas, ICT firms have no incentives to cooperate with one another for the dissemination of this new tool for communication and fall into the classic trap of the public goods problem.

As Ostrom states it, “Once a competitive market is provided, individuals can enter and exit freely whether or not they contribute to the cost of providing and maintaining the market. Thus, no market can exist for long without underlying public institutions to support it” (1990, 15). Therefore, without some over arching institution with the ability to provide benefits of the investment over and above the social and capital results, private firms will not be inclined to invest in this common pooled resource. This is not to say that the free market approach will prevent ICT diffusion, but rather that it will not allow for the diffusion at the rate a country needs to compete with countries that operate under an effective state directed approach. As long as there is no incentive, firms will not be able to overcome the common pooled resource or the public goods problem. If everyone benefits, private firms have no incentive to invest in the creation of or maintain the information communications infrastructure. It is important to note that in governing the commons, privatization, state involvement and cooperative action among private actors are necessary not only to create the common pooled resource but to maintain it as well.

**HYPOTHESES**

For this thesis, I conduct a broad statistical analysis on the impact of state intervention on ICT dissemination and then focus on the role of state intervention in the case of South Korea and how that case differs from the United States. Based on my theoretical analysis, I present and test two hypotheses in this thesis.

- The first hypothesis is that countries which have adopted the promotion of information communication technology (ICT) development as a national priority as evidenced through government prioritization, laws and financial investment have a higher rate of ICT consumption than those that do not.

- The second hypothesis is that Korea’s stronger rate of ICT consumption than the United States is due to Korea’s greater reliance on state-directed development of the ICT industry.

## METHODS

I test these hypotheses by examining the relationship between the ICT Outcomes and government intervention. The first test was a multi country quantitative test to examine the general correlation and general impact of state intervention on ICT dissemination. The second test was a more qualitative test that assesses a specific relation between state intervention and ICT between the vastly different nations of United States and South Korea.

### Quantitative Test

The first hypothesis is aimed at assessing the basic relation between state participation in the promotion of ICT and overall increase of ICT dissemination. For the purposes of this quantitative test, I only focused on promotion of ICT development elements which can be supported by the quantitative measures. The underlying theory is that state directed promotion of ICT will lead to increased development in and proliferation of the various communications tools resulting in a higher rate of ICT dissemination.

To assess the impacts of national prioritization on ICT development I analyzed the rate in several key areas of measurable ICT consumption on 30 OECD countries reported for 2002 and 2004.[xiv] The dependent variables for this analysis are Broadband Subscribership, Home Computer Penetration Rates, and ICT Consumption. The first dependent variable, Broadband Subscribership, includes DSL, cable and other technical platforms by country as reported by the OECD in 2004 (OECD Broadband Statistics, 2005). Broadband internet access availability includes the availability of broadband access through DSL or cable modems. The second dependent variable is Computer Penetration Rates in the home among various countries in 2004 as reported by the OECD (OECD Key ICT Indicators, 2006). While this is not a solo indicator of ICT dissemination, it is a valuable measurement of the association between information

technology and the information communication literacy of a country. The third dependent variable for this quantitative test will be ICT Consumption as a percentage of GDP. This variable measures the amount of ICT each country consumes in proportion to the amount of the GDP. ICT consumption is the use of technology in applications such as, but not limited to, e-commerce and e-government.

Because state involvement can be seen in a variety of ways, this paper will analyze different types of government participation as tracked by the World Bank Key Development and Data Statistics (World Bank, 2006). To measure the independent variable, ICT prioritization, I use "Government Prioritization of ICT", "Share of ICT Investment in GDP", and "Laws" relating to the use of ICT that are effective. The "Government Prioritization of ICT" variable measures the overall priority of governments' ICT policies on a scale of one to seven.[xv] "Share of ICT Investment in GDP" is actually the amount of money each country spends on the development of ICT in proportion to the amount of the GDP. This variable includes the direct financial investment as well as government incentives for the private sector to work with the public sector. The last measurement is "Laws" relating to ICT use. This measures the efficacy of laws such as those relating to electronic commerce, digital signatures, and consumer protection.[xvi] In short, the independent variables will include measurement on the creative and effective use of laws as well as government prioritization. The independent variables are constructed based on information available and reported from the 30 countries from 1999 to 2005.

The data for both the independent and dependent variables were gathered from two different sources, the OECD Purchasing Power Parities Database, (OECD, 2006) and the World Bank Development Data Group (World Bank, 2006). It was compiled from reliable sources such

as the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Telecommunication Union (ITU), the World Information Technology and Services Alliance WITSA, and the Global Information Technology Report. The World Bank measures ICT in several areas such as infrastructure and access, computer and internet use, expenditures and business and governmental environments. Finally, in order to accurately assess the impact of the ICT prioritization variable on the ICT outcome identified above, I control for Gross Domestic Product per capita (GDPpC) and Population Density (Pop Density). It is necessary to control for GDP per capita because a country with more financial resources to invest in information technology will have more ICT dissemination than an impoverished country with little or no resources to invest. I also thought it necessary control for population density because a smaller, more densely populated country will conceivably have to invest less finances, time and resources building an infrastructure than an expansive country with large, sparsely populated areas. In my analysis, I use a multiple regression with robust standard errors and a lagged dependent variable. The robust errors are to control for heteroskedasticity and the lagged dependent variable is to control for autocorrelation. In order to accept my first hypothesis, a statistically significant and positive relationship must exist between state involvement and increase in infrastructure and ICT usage.

**Qualitative Test**

Assessing the statistical relationship between various attributes of prioritization and ICT ranking is enlightening, but does not fully indicate why a small country like South Korea is outpacing the United States in ICT dissemination. Therefore it is important to test the second hypothesis that South Korea's rate of ICT usage is strong than the United States consumption rates because of Korea's greater reliance on state-directed development of the ICT industry.

Consequently, I will examine the specifically reasons why the United States is ranked lower than South Korea. In particular, I ask whether Korea's use of effective information technology governance has had a substantial impact on its diffusion and growth of information communication technology.

I used a qualitative approach to assess whether the Korean government's involvement in ICT impacted the explosion of ICT growth in South Korea. I will also assess the United States government's hands off approach and determine its impact on the US ICT industry. I have chosen the process tracing method to explain the causal linkages between government prioritization and the overall creation of an information society. The goal is to link government participation with ICT outcomes and demonstrate causal linkages between the degree and type of state intervention and development of ICT in United States and South Korea.

**Case Selection:**

**South Korea**

Measuring government intervention and its impact on ICT innovation is especially difficult as governments have varied cultural understandings of government participation and different ways of measuring ICT dissemination. Therefore it becomes increasingly important to understand why each country was chosen for examination. I chose South Korea as one the countries of comparison because in order to fully understand the potential for improvement in the US ICT industry, it is important to look at the master of this industry. South Korea did not have many of the advantages of the United States at the time of the privatization of the internet in 1994. At that time, South Korea was still in the process of stabilizing its telecom infrastructure - a feat that the United States had mastered long before. After seeing the growth and development of the internet and seeing the future of technology, the Minister of Information Communication

(MIC) lobbied for an increase in funding and support from other government agencies to complete the national infrastructure in 2007; 8 years ahead of the original 2015 completion date. The public policy initiatives launched by the MIC were successful because all of the agencies involved were encouraged to support the program by making it a priority both financially and through the investment of time. In December 2000, South Korea completed its information infrastructure project 15 years ahead of schedule (Hong 2004, 12). Today, South Korea is clearly the leader in ICT as shown by the OECD and the World Bank statistical data.

**United States**

By comparison, I chose to review the United States because it was the pioneer of the internet the technology underlying ICT and seemed to be the most likely candidate for leadership in the ICT community. However, the reality of the US ICT situation is far from anticipated. The United States lags behind many other countries that lack the industrial development, educated population, and the financial stability that the United States has known for decades. The United States has had much success with the diffusion and adoption of the internet as an economic tool (World Wide Web and e-commerce), however the progress with infrastructure and nation wide availability of access to the tool of communication has not progressed as well as other nations. Not only are many areas of the United States still without broadband infrastructure, but also many of its citizens are still without computer access in their homes, school, or on the job. And yet, the US NII (National Information Infrastructure) broadband project is still incomplete and will not be completed in the foreseeable future.[xvii]

I recognize that these two countries are vastly different in land mass and population density; but for the purpose of this analysis, I thought it more important to focus on how incredibly different each country is in their style of government involvement in the ICT

dissemination. In order to asses the role of government in the dissemination of information communication technology, I chose one country with heavy government involvement (South Korea) and one without (United States). My goal is to analyze whether a country with government intervention would do better than the one without. I assume that if the evidence reveals that the country with greater government involvement has a stronger information society than the country without, than I will have stronger evidence for my theory.

In order to analyze this hypothesis, I will use process tracing to determine the linkage between ICT outcomes and government prioritization in a variety of areas. By analyzing the results of both the quantitative and the qualitative test, it is my hope that the results can reveal a more in depth understanding of what influences the dissemination of IT. This knowledge could then be applied to increase state's participation in, consumption of, and ultimately influence over the future direction of Global ICT arena.

## ANALYSIS

### Quantitative Analysis

My quantitative results provide excellent evidence to support my first hypothesis that countries which have adopted the promotion of Information Communication Technology development as a national priority have a higher rate of ICT consumption than those which do not. The effectiveness of Government Prioritization is shown in the results of the regression tests. Table 1 show that Government Prioritization has a direct relationship with Broadband Subscribership. Similarly, the results of Table 2 reveal a relationship between Government Prioritization and Home Computer Rates. Finally, Table 3 reveals that there is a relationship between the share of ICT investment and ICT consumption. Based on these results, I confidently accept my first hypothesis.

As shown in Table 1, I conducted a linear regression with a lagged dependent variable to understand the impacts of Government Prioritization in 2002 on Broadband Subscribership Rates in 2004. I used robust standard errors to control for the inconsistent variances of the errors. The test results reveal a strong relationship between the independent variables and the dependent variable.

**Table 1: Impact of the Government Prioritization on Broadband Subscribership Rates**

| Independent Variables | *b* | Robust Standard Error |
|---|---|---|
| Government Prioritization | 2.53** | .938 |
| Population Density | .008 | .008 |
| GDP per Capita | .0004*** | .000 |
| Constant | -12.5 | 4.44 |
| R squared | .54 | |
| N | 28 | |

Dependent Variable – Government Prioritization 2002 on Home Broadband Subscribership in 2004. The asterisks (*) are used to indicate statistically significant independent variables where * if $p < .1$, ** if $p < .05$, *** if $p < .01$.

Both Government Prioritization and GDP Per Capita, are statistically significant in their impact on Broadband Subscribership Rates. With significance test result of .012, the Government Prioritization variable coefficient is statistically significant with a 98% probability that the null hypothesis can be rejected. The Government Prioritization coefficient is 2.53, which suggests that every one unit increase in Government Prioritization ranking converts to a 2.53% increase in Broadband Subscribership Rates. This is a substantial effect and provides support for my argument that countries that have adopted the promotion of ICT development as a national priority have positively impacted their ICT consumption as in the case of Broadband Subscribership.

The GDP Per Capita variable also has a statistically significant *p*-value of .000, which means there is more than a 99% certainty that the null hypothesis can be rejected. The .004 regression coefficient suggests a .004% increase in Broadband Subscribership Rates for every $1

increase in GDP per capita. To understand the impact one must remember that GDP per capita for the countries I consider is usually above $10,000. That correlates to a .4% subscriber increase for every $1000 increase in GDP per capita. Since Table 1 has R-Squared value of .54, I am confident that there is some explanatory power for this model.

A country's percentage of broadband subscribers is an important indicator in understanding its ranking in ICT growth, but it is not the only factor. Another key indicator of healthy ICT usage is the number of households with access to a home computer.

**Table 2: Impact of the Government Prioritization on Home Computer Rates**

| **Independent Variables** | ***b*** | **Robust Standard Error** |
|---|---|---|
| Government Prioritization | 7.62* | 3.69 |
| Population Density | -.029 | .046 |
| GDP per Capita | .001*** | .000 |
| Constant | -17.4 | 20.09 |
| R squared | .48 | |
| N | 28 | |

Dependent Variable – Government Prioritization 2002 on Home Computer Rates in 2004. The asterisk (*) is used to indicate statistically significant independent variables where * if $p < .1$, ** if $p < .05$, *** if $p < .01$.

According to the data in Table 2, Government Prioritization and GDP Per Capita are statistically significant in their impact on Home Computer Rates. With significance test result of .05, the Government Prioritization variable coefficient is statistically significant with a 95% probability that the null hypothesis can be rejected. Government Prioritization has a regression coefficient of a 7.62, suggesting that every 1 unit increase of Government Prioritization converts to a 7.62% increase in Home Computer Rates. A country with 50% of households having a computers would have 57.62% computer penetration it government intervention increased one unit.

The GDP Per Capita also has a statistically significant p-value of .000, which means there is a 99% certainty that the null hypothesis can be rejected. The .001 regression coefficient

suggest that for every unit of increase of GDP Per Capita correlates to only a .001 increase in Home Computer Rates, but an increase of $1000 in GDPpc means a 1% increase in rates. Since Table 1 has an R-Squared value of .48, I am also confident that this model has explanatory power for this variable.

Utilizing the data from the World Bank Share of ICT Investment from 1999 and Share of ICT Consumption data gathered that same year, there seems to be a relationship between Share of ICT Investment in GDP (the amount of money each country spends on the development of ICT in proportion to the amount of GDP) and Share of ICT Consumption in GDP (amount a country consumes in proportion to the amount of the GDP).

**Table 3: Impact of the Share of ICT Investment on the Share of ICT Consumption**

| **Independent Variables** | ***b*** | **Robust Standard Error** |
|---|---|---|
| Share of ICT Investment | .103* | .074 |
| Population Density | -.000 | .000 |
| GDP per Capita | $2.13x10^{-6}$*** | .000 |
| Constant | 1.80 | .388 |
| R squared | .05 | |
| N | 28 | |

Dependent Variable – Share of Consumption on ICT 1999 on the share of ICT Investment 1999. The asterisk (*) is used to indicate statistically significant independent variables where * if $p < .1$, ** if $p < .05$, *** if $p < .01$.

According to the data in Table 3, Share of ICT Investment and GDP Per Capita, are variables that are statistically significant in their impact on Share of ICT Consumption. Share of ICT Investment has a *p*-value of .176. In a two-tailed test that would not be significant, but being that I have theoretical expectations as to the direction of the effect this is marginally significant. The regression results reveal that a share of ICT Investment has a coefficient that is .103, which translates to a 1.03% increase in ICT consumption for every one unit increase in investment. This leads to a general assumption that a country whose government invests more

money in the Information Communications Technology will have an increase in the consumption of that technology.

Additionally, my control variable, GDP Per Capita reflects a *p*-value of .000 thus reflecting statistical significance of the variable. Hence, a country with a higher GDP Per Capita is expected to have a greater tendency towards ICT Consumption resulting in an increase of its consumption rate of $2.13x10^{-6}$ percent for every unit of increase of GDP Per Capita according to the 1999 data. The R-squared value of .05 suggests that the model only explains 5% of the variation in the dependent variable.

I also ran a regression to evaluate the impact of ICT Laws and Share of ICT Investment on Home Computer Rates; however there was no significant relationship between the dependent and independent variables. I suspect this null result is due to the difficulty in measuring the effectiveness of Laws. Many of the countries are not reporting on laws relating to ICT Use at this time, and of those that are, many are not reporting consistently. I was also unable to run a regression to analyze the impact of government prioritization in 2002 on ICT Consumption, as the comprehensive category "ICT Consumption" has not been gathered in a single category since 1999. It now appears to be reported through several more specific categories. Unfortunately many of the countries analyzed are not yet reporting in some of the various new categories as of yet. Finally, I ran regressions to analyze the impact of ICT Laws and Share of ICT Investment on Broadband Subscribership Rates and Share of ICT Investment on Share of ICT Consumption.

The effectiveness of Government Prioritization is shown in the results of the regression tests. Both Table 1 and Table 2 reveal a direct relationship between Government Prioritization and both Broadband Subscribership and Home Computer Rates. Table 3 reveals a relationship between ICT Investment and ICT Consumption Each of these results has strong coefficients

indicating that the increase in Government Prioritization leads to a significant increase in Broadband Subscribership (2.53) and Home Computer Rates (7.62) per every 1 unit increase in Government Prioritization measures. Table 3 supports the argument that increased government investment leads to higher rates of ICT consumption (.103). Therefore a one unit increase in investment translates to a 1.03% increase in ICT consumption. A statistically significant relationship exists between state involvement and increase in infrastructure and ICT usage. My quantitative analysis provides evidence that my theory of government involvement promoting ICT growth and innovation is correct.

**Qualitative Analysis**

In order to further analyze the impacts of government intervention on ICT dissemination, I conduct a qualitative analysis through process tracing to determine the causal linkages between various methods of government prioritization and ICT dissemination. I analyze each country's progress in ICT from the privatization of the internet to the creation of their modern day information society. In each case I examine the government role in building the infrastructure, managing investment strategies, and creating internet applicable laws. I also examine the role of the government in implementation the internet and broadband access into the primary and secondary educational systems. Finally, I link the government's actions to each country's current information society. Based on the results of the process tracing, I confidently accept my second hypothesis.

I begin the analysis with a country long considered the industry leader in information communication technology – South Korea – which did not even have a completed telecommunications infrastructure in 1990. After a comprehensive set of regulatory reforms, government prioritization, and incentives to create new companies within the information

technology industry, South Korea was able to eventually overtake some of the countries that were the entrenched world leaders during the industrial era. South Korea was able to accomplish this task by using its government organizations to promote and grow the emerging information technology industry.

**South Korean ICT History**

The Republic of Korea, which views the Internet and ICT as a key component of its strategic development and its ability to sustain its competitive advantages, has both high-level government backing and the infrastructure in place to support rapid growth for business and social uses (UNESCAP, 69). This construction of an effective telecommunications backbone could not have been completed without government involvement as it requires so much coordination, political commitment, policy and regulatory reform and institution-building, apart from significant physical infrastructure, that the challenge is beyond the capability of any single private investor or development bank. (UNESCAP, 70) In 1994, just after the privatization of the internet in the United States, South Korea began a comprehensive set of regulatory reforms that would reshape the new industry. James Larson (1995, 10) writes that President Kim's government announced and passed a comprehensive government reorganization plan which focused on impacting information and telecommunications. A key element of the reorganization included changes to the Office of the Minister of Communication.

The Ministry of Communication (MC) was initially responsible for the telecommunications industry including both the development of telecom infrastructure and regulation. Under President Kim's reform, the Ministry of Communication was enlarged to become the Ministry of Information Communication (MIC). This was an extremely forward thinking concept as the term "information communication" was not even a part of mainstream

communication at the time of the announcement. The essential elements of this reorganization were the alignment of the responsibility of an information infrastructure, information services, and information commerce. In addition, the President also connected those elements to the other telecom responsibilities. The changes also included transferring responsibility for most software and information services from the Ministry of Trade, Industry and Energy to the enlarged MIC, thereby allowing South Korea to adopt a more integrated approach to the converging technology industries (Larson, 1995). In short, the MIC became the central government agency for all matters dealing with information communication technologies.

Nurturing information technology industries was viewed as the key industrial policy for the 21st century. The public policy initiatives launched by the MIC were able to succeed because all of the agencies involved supported the program by making it a priority through the investment of time and finances. The office of the MIC was responsible for creating a 5 year basic plan structure which was effective in reducing the uncertainty about the future by creating a vision for the future. The "5 Year Plans" provide the government, private industry, and the information society of Korea with a vision of the future so all organizations could work together on one accord. The basic plans also included items such as building advanced information infrastructure, increasing productivity nationwide, creating new jobs, all using the information infrastructure (Hong 2004, 14). The "5 Year Plans" were created to provide a solid plan for the future, while being flexible enough to adjust to the rapid changes in society and technology. Thus every year the office of the MIC is responsible for modifying the basic plan. The South Korean government's focus and basic plan clearly impacted their development of the ICT by ensuring that the nation had an ICT infrastructure upon which to build the industry.

**South Korean Government Creates the Infrastructure**

The most obvious example of the impact of the government prioritization on the growth of ICT is the strength of the MIC and the five year plan for developing the Korean Information Infrastructure (KII) and broadband initiative. The broadband infrastructure required included devices and supporting services along with Internet Protocol based network infrastructure. It also included the basic telecom infrastructure, comprising telephone mainlines, mobile telephones and Internet backbone. Prior to creation of the broadband, networks such as the internet; operated in parallel with or overlaid telecommunication infrastructures. They were not considered to be part of the public telecommunication sector. They were used by 'closed user groups', such as the government and academia, and were not accessible by the public. When the Internet was commercialized, and operators began offering services to the public, it became a mainstream part of the public telecommunication market.

Following the announcement of the US National Information Infrastructure (NII) initiative under former Vice President Al Gore, a KII task team was established under the office of the Prime Minister (Hong 2004, 11). KII was originally slated for completion in the year 2015. After seeing the growth and development of the internet and world wide web and seeing the future of this powerful technology, the MIC lobbied for an increase in funding and support from other government agencies to complete the national infrastructure in 2007. The National Communication Administration (NCA) successfully lobbied for an earlier implementation date of the KII. With government prioritization, increased funding, and several government agencies working on project South Korea completed its information infrastructure project, in December 2000, 15 years ahead of the initial schedule (Hong 2004, 12).

**Financial Investment as an Important Part of Government Focus**

While the creation of laws to protect regulation and stimulate innovation and growth is an expected form of regulation in the industrialized countries, what makes Korea different is the use of state funding and incentives to assist in the creation of new entrepreneurial groups for growth and promotion of the industry. South Korea was able to encourage business and entrepreneurs to develop and grow this industry through government incentives, special programs and tax credits. Private firm participation enabled South Korea to overcome the public goods problem that occurs when a state must rely on organizations taking responsibility in the public commons in order for an industry to grow. This was critical to the successful rollout of the KII infrastructure. As identified in the prisoner's dilemma game, without some sort of government organization to encourage participation, many of the private firms will be less likely to invest if they feel they may be the only investors. This is especially necessary when all firms, including firm's competitors, can benefit from the creation of the infrastructure. Thus government incentives become critical when dealing with a public good.

Another reason why the government is necessary to foster financial investment in this public good is because the private sector is good at supplying wealthier and urban populations that can easily pay for the services but may be unwilling to invest in supplying those services to poor areas that can not pay for the service. Thus government investment and the contribution is necessary to transform and growth to this industry. This is the position that South Korea took and is arguably how it became the world leader in ICT. In 1999 South Korea's ICT investment was 5.9 percent of Gross Domestic Product.[xviii] In 2001 those expenditures grew to 6.8 % of the GDP.[xix] Today South Korea is still investing 6.6% of its GDP in ICT.[xx] The percentage of the GDP is important to understanding the priority that a government places on a good or service.

This percentage clearly indicates that the South Korean Government is serious about maintaining its place in the world the most advanced information society. It is the combination of laws and investments in ICT infrastructure that enables a country to effectively grow and successfully promote ICT. While impressive, none of these investments would make a difference in creating an information society if a country does not educate its future workforce to utilize and build upon the technology.

**Government Focus Improves Laws**

In addition to supporting infrastructure and garnering private firm investment, another crucial role of the government was creating efficient laws to help regulate this new industry. There were many advances in the information technology industry during the mid to late 1990's, including the growth of the world wide web, email usage, and the use of various multi-media that could now be transferred through cyberspace. This led to many issues with copyright infringement, trademark issues, and other legal issues involving business transactions that could not be foreseen before the creation of the information era. The Korean government successfully readjusted laws and regulation to increase a favorable environment for e-business and business ICT adoption and use. Korea implemented the Electronic Finance Transaction Act and the Copyright Act to eliminate clauses that potentially restricted growth and innovation of the online industry. These new policies allowed information to be posted online for use either for sale or information of products, goods, or services. This also protected the right to post literary content on line for research and consumption. In addition the government has reformed laws and regulations through the E-Commerce Act and On-Line Digital Contents Industry Promotion Act. The government is still actively pursuing the elimination of contradictory laws regarding electronic documents, electronic signatures electronic payment and the like consolidating

definitions that overlap or contradict (OECD ICT Diffusion to Business 18). Despite the many challenges involved, the South Korean government is working to readjust laws and regulation to increase a favorable environment for e-business and ICT adoption and use.

**Government Creates an Educational Program for an Information Society**

Another crucial government role was the revamping of the educational program to include information technology curricula. In response to criticism for being slow to adapt to the country's emerging knowledge-based society, the South Korean Ministry of Education (MOE), with support from President Kim Dae Jung, established a comprehensive plan for information technology use in education. Part of the plan was to create a network that connected all Kindergarten through 12th grade school together in conjunction with the national MOE and 16 local MOEs. This educational network allowed for transparent communication among the local MOEs and the school system. Once the network was established the MOE further improved the educational system by ensuring that all 10,064 schools and 220,000 classrooms had internet access.[xxi] While being connected to the internet was imperative to introducing the future workforce to the World Wide Web, it was equally important that every school receive the appropriate number of Personal Computers to support the student's technological needs. The MOE decided that it would take one PC for every five students to handle the educational needs of the Korean school system. Today each South Korean school has enough PC's to maintain that ratio.[xxii] To go one step further, the MOE recognized that a student's comfort with computer technology was most heavily influenced by their teachers; therefore the MOE ensured that every single teacher in Korea received his or her own PC.

Adding IT training to the primary and secondary education programs promoted the creation of the information society in three distinct areas; training the future workforce,

eliminating the digital divide, and ensure future demand for ICT diffusion. By preparing its students with basic skills in IT field, Korea has ensured that it will have a workforce capable of participation in the information era. Additionally, by granting computer and internet access to all students, Korea will effectively eliminate the future digital divide. The "digital divide" is the unequal distribution of the internet and other information technologies. More importantly the gap is between those who have access and know how to effectively utilize computers, information technologies and other information technology based communication tools; and those who do not. By making sure that student are trained and reliant on computers, Korea created a future demand for ICTs that will ensure future ICT dissemination within its borders. The role of the MOE and the support from President Jung emphasizes the importance of a government's involvement in the successful creation, improvement and growth of the industry, by preparing its workforce.

**South Korea's Information Society**

The result of the Korean government's focus on infrastructure investment, effective technology laws, ICT incentive and tax credit programs, and educational restructuring was the creation of a world class information society. Korea utilizes data speeds on home and mobile phones that are 5 times that of the United States. Korea also has created a communication environment where its citizens can access a cell signal virtually anywhere within its borders. More importantly, South Korea has instituted computer and internet training in its primary and secondary educational programs that will require future dependence and dissemination on ICT products. According to OECD and World Bank Statistics, the Republic of Korea is consistently reported as one of the leaders in ICT investment, government prioritization, and laws pertaining to ICT use. The public policy initiatives launched by the MIC and MOE were able to succeed

because all of the agencies involved and supported the program by making it a priority through financial investment and through the investment of time and focus. They are also listed as the world leader in broadband subscribership and home computer rates according to 2004 data. Korea is an excellent example of the potential power and strength of focused information technology governance. Korea became the leader in the development of broadband networks, cellular and wireless technology, and overall digital communication.

## United States

### US Government Creates the Internet

Like South Korea, the United States used a focused government project to jumpstart its information communications technology industry. The United States was able to lead the charge in the development of internet governance because of the Department of Defense's role in the creation of the internet during the Cold War. The goal of the project was to protect communication during a nuclear attack by creating multiple network paths and routes that could work simultaneously. Hence the internet was created as a network of networks that could allow both simultaneous and alternative routes of communication if one pathway was blocked, full, or damaged. The internet, mostly email, began to spread at participating universities and government organizations during the latter part of the 1980's. The United States government decided to move toward commercializing the internet, thus providing the American public with what was to become the most powerful tool of communication in the modern era. (Mueller, 1999)

### The United States Government Privatizing the Internet for Public Use

After the privatization of the internet in 1993, President Clinton adopted a policy he thought would spur information technology development. He suggested that the internet and the

supporting information technologies would prosper through “industry self-regulation” not government intervention. “Self-regulation” would come to mean that the United States government would not create a new organization to govern information technology or define its powers and structure. The Clinton administration essentially adopted the attitude that the Internet is a “tool of commerce” instead of a “tool of communication” and governed the development of internet and all subsequent information communication accordingly

By treating IT as a tool of commerce, the government removed itself from the involvement in the growth and development of the infrastructure and the dissemination of the related technology. This lack of involvement led to two distinct issues; first there was no industry standardization which led to disparate technology development in computer operating systems and connectivity devices, cellular technology and wireless communication. The second consequence of treating the internet like a tool of commerce was that only those who could afford the technology have access to it. If only private firms invest in the infrastructure, only those in commercial urban and affluent areas receive the infrastructure and devices necessary to advance in the information age. Without governments involvement no one was responsible for creating the conditions that attract private sector investors to invest in rural or poor communities. Only the government can make laws, regulations and start-up procedures for private companies as simple, transparent and predictable as possible; ensure fair competition; and ensure that back-up services, skilled personnel and capacity are in place to enable operations to run smoothly. (UNESCAP, 70).

John Major explains in his paper “Current Trends and Likely Futures in Wireless Systems”, that the US government stimulated the world wide trend of governments’ embracing the issue of communication, and wireless communications in particular, as a national priority

when Vice President Al Gore introduced the two new acronyms, NII (National Information Infrastructure)[xxiii] and GII (Global Information Infrastructure) while addressing Congress (1995, 12). However, the concept of the NII was never fully developed. In the face of the market economy approach to the development of the infrastructure, neither the NII nor the GII have been fully realized.

**The US Government Transitions Dissemination of the Internet Infrastructure to the Private Sector**

Since the United States did not see the internet or its underlying infrastructure as a public good, there was no plan for the government to manage it. Much of the focus was placed on managing the World Wide Web, the part of the Internet accessed through a graphical user interface and containing documents often connected by hyperlinks which are normally used to pass and display information as well as purchasing and selling goods and services. Outside of email communication, the US government did not focus on growing the parts of the internet that is used for communication, data transfer, streaming video and sound transfer. Those items were only supported by the private sector. As a result, there was no collective action taken by the US government to stimulate or grow the infrastructure to support these new tools. It was believed that a free market approach to the development of the infrastructure was critical to the appropriate development of products and services. With the initial success of the WWW, the Internet was viewed as an excellent demonstration of allowing market forces to guide the computer industry. So instead of managing this industry the United States relied on the private firms to stimulate the growth. As the private sector interest in the internet has increased, the role of the US government in the internet has declined steadily over the last 10 years. This is unfortunate considering the continuing roles and responsibilities still needed from the

government to make this NII a reality. Without direction, the US broadband infrastructure has not been completed and the growth of the US information technology industry appears stagnate in comparison to other countries.

The US broadband project is incomplete and will not be completed in the foreseeable future. Private US actors have been unable to realize the project's potential due to the public goods issue. As one of the more expensive public goods in the modern era, the broadband infrastructure is cost prohibitive for any private firm to invest in individually. In addition, many firms are hesitant to invest in a good that provides the service that will benefit the competition. Therefore, it is unlikely that this broadband infrastructure will be complete without a partnership between the public and the private sector. The US government is the only entity that can facilitate the public and private organizations' participation in working together under a common set of rules and moving beyond their islands of isolation. Without substantial government direction, the US NII will never become a reality. In 2005 the United States only has 49 million broadband subscribers out of 300+ million inhabitants. This means that less than a fifth of the population is a broadband subscriber. According to the OECD Broadband rankings that puts the United States in 12$^{th}$ place behind Iceland, Korea, Denmark, and the Netherlands (2004). It is important to note, that the United States cannot increase its subscribership rate without increasing the infrastructure. There is so much potential for the US government to expand in the area of information communications diffusion; but it has not and cannot be done without some sort of governance from the US government.

**The Lack of Funding for the US Infrastructure Development**

A significant obstacle to infrastructure development is the lack of funding. The United States has not invested much financially in the ICT infrastructure. This is not to say that the

United States government does not contribute to ICT. The United States invest most of its dollars on software, not infrastructure. According to OECD and World Bank statistics, the United States is one of the largest contributors of ICT expenditures, spending about 7.9% of its GDP on ICT investment. The investment dollars, however, go to a variety of ICT sources.[xxiv] Software investment is actually 14.2% of total investment dollars, with investment in office and data processing equipment equaling 8% and investment in telecom equipment (which includes infrastructure) only totaling 5% according to 2000 OECD reports. I believe that the US is choosing to spend more on software because of two reasons. The United States government is the largest organization in the country and the investment of maintaining the necessary software upgrades to manage the country is a monumental expense. Software is a recurring investment for any organization as software is constantly being created to manage new requirements and integration systems, and to upgrade to eliminate previous system defects or guard against viruses. While the US software investment is necessary, it takes much needed government funding from the infrastructure development. This means the US government will have to find alternative sources to develop the NII infrastructure.

While ICT infrastructure requires a significant capital investment, most national governments, especially in the developing world, are unable to meet the challenges alone. With few exceptions, private businesses and government organizations have funded much of the world's non-military ICT infrastructure. There is little indication that this trend will decrease. In fact, as more and more governments make it clear that they are not able or willing to finance the construction of ICT infrastructure, the role of non-governmental investment becomes increasingly more pivotal.

Outside of the government, the primary group that can be accountable for this kind of investment would be private firms. As I mentioned before, the private sector is good at supplying wealthier and urban populations that can easily pay for services but may not be willing to supply poor, marginalized and rural people without some sort of incentive. Large distances and thinly spread populations make for high infrastructure costs in providing fixed-line telephone systems for rural or remote areas since these areas do not provide adequate profits. Other investors can include Non-Governmental Organizations (NGO's) who are able to make donations to help with the cost, by supporting research and consultation, co-finance ICT projects, and establishing cross-subsidy schemes to encourage commercial network operators to channel investments towards less commercially attractive regions. (UNESCAP, 70) Unfortunately this kind of investment is focused on third world and impoverished areas. Many of these organizations are not even considering the United States for this kind of special attention. Without government creating conditions to attract private sector investors, the United States will be unable to complete the NII. It seems that the United States is adopting the philosophy of many other nations that it is the responsibility of the private sector to provide the infrastructure. Countries like South Korea have, however, adopted another philosophy and are currently finished with their Broadband infrastructure.

**Government Creates New Laws for the Internet**

Robert E. Kahn explains that in the case of the US infrastructure development, the government must provide leadership in the removal of barriers where they inhibit progress (1994, 6). The most obvious barrier to the growth and development of the internet are the legal and regulatory barriers. Attempts to regulate this new technology have been fraught with much difficulty. This is largely due to the decentralized and international nature of the internet. The

creators of cyberspace engineered it to become a self contained, non regulated entity capable of maintenance by all participants. However, after the privatization of the internet and the world's current dependence on information technologies throughout the business sectors, scholars quickly realized that something must change. Once the internet became an integral part of commerce, storing, transmitting, and transferring customer data, it could no longer remain the isolated and autonomous realm. Those committed to having the net remain free and unregulated have underestimated the potential issues currently facing ordinary citizens who are not truly sophisticated enough to manage their own information in cyberspace. The internet for all its uses, both in and out of the business realm, has become too complex to exist as a self-contained and self-regulated territory divorced from governance (Margolis 2000, 181). Self-regulation and voluntary enforcement is insufficient in the face of sophisticated cyber crimes. As a result, a need for internet aware policies that address infrastructure, content, and consumer protection has surfaced.

In the United States, the current telecommunications regulation has had a debilitating effect on the emergence of integrated information communication. Since the US government adopted and maintained decentralized information technology establishment, many of the laws needed to manage the convergence of technology utilized in multi media has not been created. According to Charles Ferguson (2004) in his web article "The US Broadband Problem", industries originally evolved as a collection of separate, regulated oligopolies or monopolies in voice telephony, broadcast radio and television, postal services, cable television and wireless services. For over fifty years, these were stable industries exhibiting low rates of technical change (Ferguson 2004). Now, digital technology is causing the convergence of many industries, ranging from photography to software publishing to entertainment to voice telephone

service. In his book Cyber Policy and Economics in an Internet Age, Lehr states that the existing communication policy organized along traditional industry lines, e.g., telephone, cable television and broadcast regulators makes little sense in the converged world of the internet. (2002, 7) As a result, the United States does not seem to have an organization responsible for the development and diffusion of information communication nor does it have a clear plan for dealing with debilitating regulation with in this new industry. This produced an increasing need for new and revised legislation to deal with this technology.

In addition to the dealing with many disparate industries, the US Congress also has difficulty with the ICT legislation because much of the regulation was written in the early days of ICT diffusion and ICT technology growing too rapidly for the laws to keep up. This legislation was written in the early days of the internet diffusion and does not address a lot of the current technologies and issues necessary to eliminate barriers between the industry segments, local and long distance services, broadcast and cable television, etc. (Sirota, 2004). While this act did provide some direction for removing barriers, this law did not result in the clarification and direction that Congress had hoped. Out of all the major issues facing information technology today, the most fundamental is that the technological innovations are outpacing the laws to govern it. By the time the law making process is completed in US Congress, the technological advances have rendered a law moot or inappropriate (Klotz 2004, 142).

**US Education Program**

The US government is not taking advantage of the US public school program as a place to train the future workforce for careers in ICT, eliminate the digital divide or create future demand for ICT products. Unlike South Korea, many of the students in the United States public school systems are not being prepared for the information era. Unfortunately the current United

States education system was designed in 1956 during the industrial era and has not evolved much over the last few decades. One reason that the curricula is not preparing the students for the information era, is that many of the schools on the lower economic strata do not have computers for the teachers, much less the students. This is not true for all schools; communities on the upper economic strata are ensuring that there are adequate computers classes, labs and even laptops for children to take homes. Working class students and those in the lower economic strata are not so fortunate, as many may not even have enough chairs or books in the classroom for all of its students. For many of them a computer lab is a luxury, and a laptop is out of the question. Therefore the only children being prepared for careers in IT are those that are in the upper echelon of society. The result is a national digital divide.

In this divide is ultimately impacted by factors such as economics, education, race, and geographical location. No where is the gap more evident than in United States public school system. While countries like South Korea are using their classrooms to eliminate the digital divide, the US public schools system is the main contributor to it. This divide in the nation's educational systems could ultimately impact the demand future dissemination of ICTs. Students that are introduced to computers at an early age will continue to have a demand for the technology. By ensuring that student are trained and reliant on computers, the US can create a future demand for ICTs that will ensure future ICT dissemination within its borders.

**The US Information Society**

In the late 1990's when America was basking in the glow of the growth of the "Information super-highway", persistent reports were brought to the nation's attention that there were groups of Americans that were unable to take advantage of the opportunities presented by the new technology. The impoverished and certain minority groups were left behind in the race

for information and technology. Those who are poor and disadvantaged within the United States are in many cases as technologically disadvantaged as those in third world countries. The Department of Commerce suggested in their "Falling Through the Net" series, that many people within the United States do not have computers in their homes, do not use computers at work, and do not have computers in their schools. Many of these people work in jobs that do not utilize computers, do not have access to a library with up to date technology and could not afford to have a computer in their home. In 2003, US Home Computer Rates reached an all-time high of 61.8% or roughly 173+ million citizens. That still leaves approximately 107 million people without the advantage of computers in their homes and unable to participate in the information revolution.[xxv] This is not to say that other technology leaders do not have their own digital divide. In Korea, the home computer penetration rate was 78% of the population, with hopes of reaching the other 22% through access to computers in the classrooms.

Unfortunately the United States does not have a successful plan to close the growing digital divide within the country. People who have access to technology are utilizing the technologies in every aspect of their personal, academic and professional lives. Conversely, those without the income to afford computer access in the home, schools, or community centers are not reaping the benefits of the information age and are falling further behind in the technology era. In a culture that fosters competition and survival of the fittest, it may be difficult for many to see education and the development of an information society as a public good. This is unfortunate considering a nation that has a public school system has to be consciously aware of preparing its workforce to keep the nation competitive in the international arena. In the end, and information society cannot be built if 40% of the team is expected to participate lacks the proper equipment or training. Preparing an information society that is able to compete in IT is a

public good that requires government involvement. Without a concrete plan to close this gap, the US will not have the information society to ensure the nations competitive advantage in the information era.

**CONCLUSION**

The world has been firmly launched into the information era and the creating of a stable ICT infrastructure is the foundation for developing a strong information society. We exist in an age where virtually every industry in the world is now involved in the storing, managing and transmitting data. Therefore, developing a strong information communication environment has become a common goal for many countries around the world; however some have been more successful than others. In order to analyze the role of a government in the creation of an information society, I conducted a multi-country quantitative test to examine the general impact of state intervention on ICT dissemination. My regression results showed government prioritization as a statistically significant variable on broadband subscribership and computer penetration rates. This supports my general theory that a statistically significant relationship exist between state involvement and ICT usage.

In order to better understand how a government might promote the innovation and dissemination of ICT, I also conduct a qualitative analysis to analyze the difference in approach to informatization by South Korea and United States. The South Korean government focused on the communications aspects of the internet and governed the building of the information infrastructure, like any other public good. The Korean government created the office of the MIC whose primary goal was to coach, entice, and cajole all the government agencies and private firms involved to work together. The United States focused on the internet as a tool of commerce and adopted the free market approach to the creation of the infrastructure and did not

treat the infrastructure as a common good. The United States relied solely on private firms to invest in the common IT infrastructure has set up the perfect prisoner's dilemma. I argue that the US infrastructure has not been completed because of the lack of government involvement for this new tool of communication. I also argue that it was this government involvement that propelled the development of ICT in South Korea, - not government intervention by way of regulation, but government intervention by ways of organizing, promoting and incenting growth. My results reveal that state involvement has become necessary to get competing technology firms to work together for the building of an ICT infrastructure.

Moreover, it is important to understand that because of the unique nature of internet technology, provisioning of this communications tool requires unique central methods that would not normally be needed for other industries. Therefore the policy implications for the United States suggest an increase in the level of government involvement. This is not to suggest that what worked so well for South Korea will work in the United States. The two countries have very different government structure and different culture, and the creation of an MIC may not have the affect on American business that it had in Korea. But it has become clear that in order to create an environment that promotes wider use of the Internet and an all-inclusive information society, the US governments needs to be involved for following reasons. First, the private sector involvement cannot preclude the need for policy makers to better understand how the internet is evolving, encourage infrastructure development and to assess policy implications. Second, one cannot rely on the private industry to diffuse a service or tool to areas that cannot provide a direct economic return. Third, there is now and will always be a need for government involvement in the diffusion of any service or tool that will be used for communication, education or for commerce and international trade. Fourth, only the government can create an environment that

promotes wider use of the internet and an “all-inclusive” information society by making the internet and broader broadband infrastructure available to everyone by improving the local infrastructure and reducing access costs. Fifth, only the government can develop a legal and security framework for online activities by developing comprehensive e-legislation that covers digital signatures, encryption, public key infrastructure, protection of intellectual property and online taxation.

The United States will need to make ICT development one of the nation’s top priorities. It will have to review its stance on the Internet as a tool of commerce and re-examine whether or not it is capable of operating solely on a self-governing basis. To ensure that the United States does not fall farther behind, the government must embrace its role in the growth and dissemination of this tool. The government can do this by encouraging both the private and public sector working together in the creation of a nationwide broadband infrastructure by updating current industry regulations which create barriers to participation, and creating incentives for the private sector to work with the public sector. This undertaking would take massive governmental and bureaucratic changes to facilitate; however, these changes are necessary if the United States is interested in substantially improve its rate of ICT growth and diffusion. The first task to improving the rate of growth and dissemination of the Information Communications Technology must be completing a National Information Infrastructure that will allow every home, school and business access to this powerful tool of communication.

## NOTES

[i]This information came from the article "The Future is South Korea; Tech Firms Try Out Latest in Worlds Most Wired Society" which inspired my research questions. It was written by Birgitta Forsberg of the San Francisco Chronicle in March of 2005.

[ii] OECD Key ICT Indicators, Broadband Subscribers per 100 Inhabitants in OECD Countries, June 2004.

iii Broadband technology is computer technology that supports voice, data, image, and video; an internet; a public network for government information services, medical information and education. This is not to be confused as a single network, but a loose aggregate of many different networks and services with common or related access; public policy debate.

[iv]This definition was taken from the glossary of the Information and Communication Technology As a tool for Empowerment located in the World Bank Empowerment Sourcebook. Simone Cecchini and Talat Shah, April 2002.

[v] Innovation is defined as the successful exploitation of new ideas. In the case of technology, innovation is the introduction of a new idea into the marketplace in the form of a new product or service, or an improvement in organization or process

[vi] The Internet is not limited to Broadband or high speed internet access, it also uses some elements of the infrastructures created for PSTNs e.g. dial-up service uses local loops. In that sense, the Internet and other private networks that overlaid public networks were recorded during historical data collection. For a variety of reasons, most analysts expect a transition from circuit switched networks to Internet Protocol networks Sometimes these are referred to as 'next generation networks'. These networks are expected to and increasingly can provide any service which might once have needed a specialized or dedicated infrastructure. Telecommunication carriers, for example, which once specialized in telephony are beginning to provide television services over DSL connections. At the same time, an increasing number of cable television networks are providing Internet telephony.

[vii] DSL – Digital Subscriber Lines is a family of digital telecommunications protocols designed to allow high speed data communication over the existing copper telephone lines between end-users and telephone companies.

[viii] A distinction between cellular and fixed wireless is that some fixed systems require an antenna fixed on a building to receive service. Cellular networks provide a greater ability for users to roam between cells than do fixed wireless networks (though fixed wireless networks can provide mobility within their coverage areas). Two-way broadband access via satellite requires a user to have a receiver capable of downstream and upstream communication. One-way satellite broadband access, and broadband access provided via digital television, requires an alternative uplink technology (generally via an analogue or ISDN telephone line).

[ix] WiMAX refers to broadband wireless networks that are based on the IEEE 802.16 standard, which ensures compatibility and interoperability between broadband wireless access equipment.

[x]Prior to widespread liberalization, networks such as the internet, which operated in parallel with or overlaid telecommunication infrastructures, were not considered to be part of the public telecommunication sector. The internet, of course, uses some elements of the infrastructures created for PSTNs e.g. dial-up service uses local loops, but originally the public telecommunication sector excluded private networks that either did not automatically connect to the public network or which had limitations on membership. They were used by 'closed user groups', such as academia, and were not accessible by the public. When the Internet was commercialized, and operators began offering services to the public, it became a mainstream part of the public telecommunication market.

[xi] This definition for Public goods was taken from Wikipedia found at http://en.wikipedia.org/wiki/Public_good

[xii] The InterNational Committee for Information Technology Standards (INCITS) is the development forum for market-relevant standards that drive the Information Technology Industry founded in 2001.

[xiii] National Institute of Standards and Technology (NIST) is a key technical contributor to the nation's standards infrastructure founded in 1901.

[xiv] By narrowing my analysis to the OECD countries, I am able to focus on countries that share a commitment to democratic government and the market economy. The OECD gathers statistical information to that covers economic and social issues, from macroeconomics to trade, education, development and science and innovation.

[xv] A rating of 1 means ICT policies are nonexistent and a rating of 7 means that ICT policies are well developed and have been implemented. This data is from the World Economic Forum's Global Competitiveness Report 2002-2003.

[xvi] Ratings range from 1 to 7; a rating of 1 means the laws are nonexistent; a rating of 7 means that the laws are well developed and enforced. This data is from the World Economic Forum's Global Competitiveness Report 2002-2003.

[xvii] The NII has been described as a 500 channel interactive multimedia video/cable network; numerous "edutainment products and services; the natural evolution of today's telephone system.
[xviii] OEC ICT at a Glance for South Korea 1995-2002
[xix] OEC ICT at a Glance for South Korea 1995-2002
[xx] OEC ICT at a Glance for South Korea 2000-2004
xxi A Case Study of ICT and School Improvement at Kyungin Elementary School, Seoul, Korea July 31 2001
[xxii] A Case Study of ICT and School Improvement at Kyungin Elementary School, Seoul, Korea July 31 2001
[xxiii] The NII has been described as a 500 channel interactive multimedia video/cable network; numerous "edutainment products and services; the natural evolution of today's telephone system from one that is choice-oriented to one that supports voice, data, image, and video; an internet; a public network for government information services, medical information and education. This is not to be confused as a single network, but a loose aggregate of many different networks and services with common or related access; public policy debate.
[xxiv] ICT, if you will recall, includes not only internet infrastructure, but also computers, ancillary equipment, support services, firmware and software.
[xxv] OECD Home Computer Rates report for 2003 and 2004.

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# Appendix A: OECD and World Bank ICT Statistical Data

| Country | Population Density 2005 | Population Density 2000 | GDP Per Capita 2002 | Share of ICT Investment in GDP 1999 | Share of ICT Consumption in GDP 1999 | Government Prioritization of ICT (2002) | Laws Pertaining to ICT Use | Home Computer Rates 2004 | Broadband Subscribership 2004 |
|---|---|---|---|---|---|---|---|---|---|
| Australia | 3 | 2 | 27,000 | 4.4 | 2.3 | 4.9 | 4.8 | 66 | 7.7 |
| Austria | 97 | 97 | 27,700 | 2.2 | 2.8 | 4.9 | 4.26 | 58.63 | 10.1 |
| Belgium | 341 | 338 | 29,000 | 3.4 | 1.6 | 4.3 | 5.7 | 0 | 15.5 |
| Canada | 3 | 3 | 29,400 | 2.2 | 2.3 | 4.8 | 5.5 | 66.8 | 17.6 |
| Czech Republic | 129 | 130 | 15,300 | 5 | 1.8 | 4.3 | 4.2 | 23.77 | 2.5 |
| Denmark | 125 | 124 | 29,000 | 2.9 | 1.9 | 5.8 | | 79.32 | 19 |
| Finland | 15 | 15 | 26,200 | 3.5 | 2.2 | 5.7 | | 57.05 | 14.9 |
| France | 110 | 107 | 25,700 | 2.2 | 1.9 | 4.7 | | 49.78 | 10.5 |
| Germany | 231 | 231 | 26,600 | 2.7 | 1.9 | 4.9 | 4.96 | 68.7 | 8.4 |
| Greece | 84 | 83 | 19,000 | 2.3 | 2 | 4.3 | | 28.98 | 0.4 |
| Hungary | 109 | 110 | 13,300 | 4.2 | 3 | 4.4 | 4.9 | 31.88 | 3.6 |
| Iceland | 3 | 3 | 25,000 | 1.7 | 2.6 | 4 | 5 | 85.73 | 18.2 |
| Ireland | 58 | 54 | 30,500 | 1.9 | 1.2 | 5.1 | | 46.28 | 3.3 |
| Italy | 191 | 192 | 25,000 | 3.4 | 2.3 | 3.9 | | 47.35 | 8.1 |
| Japan | 338 | 336 | 28,000 | 4.8 | 2.4 | 6.1 | 4.2 | 78.2 | 15 |
| Korea | 483 | | 19,400 | 4.3 | 3.4 | 5.4 | 4.8 | 77.8 | 24.8 |
| Luxembourg | 174 | 168 | 44,000 | 2.4 | 1.8 | 2.5 | | 67.26 | 9.8 |
| Mexico | 52 | 51 | 9,000 | 3.2 | 1.4 | 4.2 | | 11.6 | 0.9 |
| Netherlands | 399 | 383 | 26,900 | 4.5 | 2.7 | 4.9 | 4.6 | 66.19 | 19 |
| New Zealand | 15 | 14 | 20,200 | 2.5 | 3.1 | 4.4 | 4.5 | 47 | 4.7 |
| Norway | 14 | 12 | 31,800 | 2.3 | 2 | 5.2 | | 71.54 | 14.8 |
| Poland | 122 | 120 | 9,500 | 4 | 1.9 | 2.9 | | 36.14 | 2.1 |
| Portugal | 114 | 111 | 18,000 | 2.9 | 2.1 | 4.9 | | 41.31 | 8.2 |
| Slovak Republic | 110 | | | 3.3 | 1.6 | 4.1 | | 0 | 1 |
| Spain | 85 | 80 | 20,700 | 2.8 | 2 | 4.5 | | 52.13 | 8.1 |
| Sweden | 20 | 20 | 25,400 | 5.3 | 2.3 | 5.1 | | 69.2 | 14.5 |
| Switzerland | 179 | 174 | 31,700 | 3 | 1.6 | 4.7 | 4.56 | 64 | 17.5 |
| Turkey | 92 | 87 | 7,000 | 3.1 | 1.9 | 3.8 | 2.9 | 10.25 | 0.7 |
| United Kingdom | 244 | 242 | 25,300 | 3.4 | 2.5 | 5 | 5.2 | 65.26 | 10.5 |
| United States | 31 | 30 | 37,600 | 5.3 | 2.5 | 5.2 | 5.4 | 61.8 | 12.9 |

## Appendix B: Government Prioritization of ICT Ranking (2002)*

| Ranking | Country | Government Prioritization |
|---|---|---|
| 1 | Japan | 6.1 |
| 2 | Denmark | 5.8 |
| 3 | Finland | 5.7 |
| 4 | Korea | 5.4 |
| 5 | Norway | 5.2 |
| 5 | United States | 5.2 |
| 7 | Ireland | 5.1 |
| 7 | Sweden | 5.1 |
| 9 | United Kingdom | 5 |
| 10 | Australia | 4.9 |
| 10 | Austria | 4.9 |
| 10 | Germany | 4.9 |
| 10 | Netherlands | 4.9 |
| 10 | Portugal | 4.9 |
| 15 | Canada | 4.8 |
| 16 | France | 4.7 |
| 16 | Switzerland | 4.7 |
| 18 | Spain | 4.5 |
| 19 | Hungary | 4.4 |
| 19 | New Zealand | 4.4 |
| 20 | Belgium | 4.3 |
| 20 | Czech Republic | 4.3 |
| 20 | Greece | 4.3 |
| 23 | Mexico | 4.2 |
| 24 | Slovak Republic | 4.1 |
| 25 | Iceland | 4 |
| 26 | Italy | 3.9 |
| 27 | Turkey | 3.8 |
| 28 | Poland | 2.9 |
| 29 | Luxembourg | 2.5 |

* Data retrieved for the OECD Purchasing Powers Parities Database. Information Communications and Technology Data

## Appendix C: Laws Pertaining to ICT Use Ranking (1999)*

| Ranking | Country | Laws Pertaining to ICT Use |
|---|---|---|
| 1 | Belgium | 5.7 |
| 2 | Canada | 5.5 |
| 3 | United States | 5.4 |
| 4 | United Kingdom | 5.2 |
| 5 | Iceland | 5 |
| 6 | Germany | 4.96 |
| 7 | Hungary | 4.9 |
| 8 | Australia | 4.8 |
| 8 | Korea | 4.8 |
| 10 | Netherlands | 4.6 |
| 11 | Switzerland | 4.56 |
| 12 | New Zealand | 4.5 |
| 13 | Austria | 4.26 |
| 14 | Czech Republic | 4.2 |
| 14 | Japan | 4.2 |
| 16 | Turkey | 2.9 |
| | Denmark | |
| | Finland | |
| | France | |
| | Greece | |
| | Ireland | |
| | Italy | |
| | Luxembourg | |
| | Mexico | |
| | Norway | |
| | Poland | |
| | Portugal | |
| | Slovak Republic | |
| | Spain | |
| | Sweden | |

* Data retrieved for the OECD Purchasing Powers Parities Database. Information Communications and Technology Data

## Appendix D: Home Computer Penetration Rates (2004)*

| Ranking | Country | Home Computer Penetration Rates |
|---|---|---|
| 1 | Iceland | 85.73 |
| 2 | Denmark | 79.32 |
| 3 | Japan | 78.2 |
| 4 | Korea | 77.8 |
| 5 | Norway | 71.54 |
| 6 | Sweden | 69.2 |
| 7 | Germany | 68.7 |
| 8 | Luxembourg | 67.26 |
| 9 | Canada | 66.8 |
| 10 | Netherlands | 66.19 |
| 11 | Australia | 66 |
| 12 | United Kingdom | 65.26 |
| 13 | Switzerland | 64 |
| 14 | United States | 61.8 |
| 15 | Austria | 58.63 |
| 16 | Finland | 57.05 |
| 17 | Spain | 52.13 |
| 18 | France | 49.78 |
| 19 | Italy | 47.35 |
| 20 | New Zealand | 47 |
| 21 | Ireland | 46.28 |
| 22 | Portugal | 41.31 |
| 23 | Poland | 36.14 |
| 24 | Hungary | 31.88 |
| 25 | Greece | 28.98 |
| 26 | Czech Republic | 23.77 |
| 27 | Mexico | 11.6 |
| 28 | Turkey | 10.25 |
| 29 | Belgium | 0 |
| 29 | Slovak Republic | 0 |

* Data retrieved for the OECD Purchasing Powers Parities Database. Information Communications and Technology Data

## Appendix E: Broadband Subscribership (2004)*

| Ranking | Country | Broadband Subscribership |
|---|---|---|
| 1 | Korea | 24.8 |
| 2 | Denmark | 19 |
| 2 | Netherlands | 19 |
| 4 | Iceland | 18.2 |
| 5 | Canada | 17.6 |
| 6 | Switzerland | 17.5 |
| 7 | Belgium | 15.5 |
| 8 | Japan | 15 |
| 9 | Finland | 14.9 |
| 10 | Norway | 14.8 |
| 11 | Sweden | 14.5 |
| 12 | United States | 12.9 |
| 13 | France | 10.5 |
| 13 | United Kingdom | 10.5 |
| 15 | Austria | 10.1 |
| 16 | Luxembourg | 9.8 |
| 17 | Germany | 8.4 |
| 18 | Portugal | 8.2 |
| 19 | Italy | 8.1 |
| 19 | Spain | 8.1 |
| 21 | Australia | 7.7 |
| 22 | New Zealand | 4.7 |
| 23 | Hungary | 3.6 |
| 24 | Ireland | 3.3 |
| 25 | Czech Republic | 2.5 |
| 26 | Poland | 2.1 |
| 27 | Slovak Republic | 1 |
| 28 | Mexico | 0.9 |
| 29 | Turkey | 0.7 |
| 30 | Greece | 0.4 |

* Data retrieved for the OECD Purchasing Powers Parities Database. Information Communications and Technology Data