Identifying Best Practices for Supporting Broadband Growth: Methodology and Analysis

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Abstract.

This paper presents a methodology for identifying best practices followed by various countries worldwide for supporting broadband growth. It also investigates and analyses these practices. The methodology used to locate the best practices is based on three main steps: (a) the presentation of the main factors that have a major impact on broadband growth; (b) the definition of what is a "best practice" based on quantitative criteria; (c) the calculation of a best practice index and a good practice index, which indicates that a country followed these best or good practices to support its broadband growth respectively. This methodology indicated that Denmark, United States, Japan, Canada and Rep. of Korea followed best good practices.

Keywords. Broadband, Best Practices, Telecommunications policies

1. Introduction

"Broadband networks will be as critical to the 21st century as roads, canals, and railroads were to the 19th Century and the Interstate Highway System and basic telephone networks were to the 20th Century" (Michael Copps, 2003). Generally speaking, broadband describes high-speed, high-capacity data communication making use of a wide range of technologies that often have diverse characteristics and seem appropriate for certain network scenarios and situations. There is no specific (international) definition or unique standard for broadband and the range of service speeds varies typically from 128 Kbps (or 200 Kbps according to the Federal Communications Commission -FCC¹- of United States) to 100 Mbps for broadband access. For instance ADSL2+ supports speeds up to 16 Mbps, Cable up to 30 Mbps, while at the high-end VDSL offers up to 52 Mbps and WiFi 802.11g up to 54 Mbps of aggregate bandwidth with next generation fiber providing capacities to the home up to 100 Mbps. For the purpose of this paper we consider as broadband connection every connection which supports speeds greater than 200 Kbps.

Broadband is a key element of the developments that are taking place in the electronic communications markets. Consumers are benefiting from lower prices and higher speeds and a variety of broadband offers due to increasing competition in this market. Therefore, one of the main objectives, in many countries, is to support broadband growth. For example,

¹ http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-208A1.pdf, accessed on 9/1/07.

broadband is considered crucial to European competitiveness. To this direction, the European Commission (EC) has been particularly active in promoting broadband developments. In particular, the EC adopted an initiative supporting the Lisbon 2010 goals, i2010, where broadband take-up is considered an important factor for the emerging digital economy and competitiveness.

In general the policies that the countries adopt for the development and deployment of broadband is strongly related to Internet and broadband penetration, as well as to the percentage of the population that live in rural or remote areas. In particular, counties with high penetration rates focus on the preservation and extension of these rates.

The main focus of this paper is to summarize the lessons learned from countries worldwide that present high broadband penetration rate. The policies adopted by these countries for supporting the broadband growth could be proved very beneficial for countries with very low broadband penetration rate (such as Greece). However, the high broadband penetration rate cannot alone stand as the criterion for considering a broadband strategy of a country as a best practice. There are more criteria and factors that have a major impact on the broadband penetration growth, which this paper tries to address.

Until now, some research work has been presented concerning lessons learned from broadband development (Frieden, 2005).

Based on the above, this paper tries to quantify the above factors for locating the countries worldwide that followed best practices for supporting broadband growth. The rest of the paper is structured as follows: the section that follows presents the status of broadband worldwide, while Section 3 describes the factors that affect the broadband growth. Section 4 constitutes a methodology adopted for quantifying the above factors and for providing a definition of "best practice for supporting broadband growth" based on quantitative criteria. The results of this methodology are the best practice index and the good practice index, which indicate that a country adopted best or good practices for supporting its broadband growth. Section 5 (i.e. "Best practice analysis") presents the calculation of the best practice and good practice index and discusses the results. The last section (i.e. "Conclusions") summarizes the results of the paper as well as the main characteristics of a best practice for supporting the broadband growth of a country.

2. Broadband Worldwide

This section presents briefly an overview of broadband worldwide. This section is, thus, focused on the comparative results of a survey conducted on an international level. In particular, the results presented in the next paragraphs fall into the following directions:

- broadband penetration
- broadband access technologies
- competition in telecommunications market
- broadband access cost
- broadband services

Figure 1 presents statistics concerning broadband penetration, Internet penetration, and broadband access technologies.

The information presented in Figure 1 is commented in the following paragraphs.



Legend:

(1) OECD Broadband subscribers per 100 inhabitants, by technology, June 2006

(2) Internet Penetration per 100 inhabitants, Internet World Statistics, January 11, 2007 (September 18, 2006 for European countries) (http://www.internetworldstats.com)

Figure 1: Statistics concerning broadband penetration, Internet penetration, and broadband access technologies

2.1. Broadband penetration

Regarding the number of broadband subscriptions, based on OECD data, it has increased 33% from 136 million in June 2005 to 181 million in June 2006. This growth increased broadband penetration rates in the OECD from 11.7 in June 2005 to 15.5 subscriptions per 100 inhabitants one year later (Figure 1).

According to OECD data (<u>www.oecd.org/sti/ict/broadband</u>), in June 2006, six countries (Denmark, the Netherlands, Iceland, Korea, Switzerland and Finland) led the OECD in broadband penetration, each with at least 25 subscribers per 100 inhabitants. Denmark now leads the OECD with a broadband penetration rate of 29.3 subscribers per 100 inhabitants. This country along with Australia, Norway, the Netherlands, Finland, Luxembourg, Sweden and the United Kingdom presented the higher net increase between the second quarter of 2005 and the second quarter of 2006 (Figure 2). Both Korean and Japanese broadband markets are advancing to the next stage of development, where existing subscribers switch platforms for increased bandwidth. In Korea, fiber-based broadband connections grew 52.4% during 2005. Japan leads the OECD in fibre-to-the-premises (FTTP) with 6.3 million fibre subscribers in June 2006.



Figure 2: OECD Broadband penetration (per 100 inhabitants) net increase Q2 2005-Q2 2006, by country (Source: OECD)

Given the fact that penetration grows, broadband providers in the OECD are increasingly offering voice and video services over this platform. The speeds offered by providers are also increasing.

2.2. Broadband access technologies

As far as it concerns broadband technologies, it appears that DSL stands as the leading broadband platform, followed by cable modem access. In particular (according to OECD Broadband Statistics, June 2006, Figure 1), DSL accounts for 63% (from 62% on December 2005) and cable modem for 29 (from 31% on December 2005). Regarding other technologies (e.g. fiber, LAN, satellite and fixed wireless), they account for 8% (from 7% on December 2005). Alternative technologies are usually related to the morphology of each country, the percentage of rural and remote areas, as well as to the broadband penetration. In particular, countries with high penetration rate seem to adopt more advanced technologies, as for example fiber to the home (FTTH), while countries with a high percent of rural population rend to wireless or satellite.

The global trend in broadband access technologies is that cable and alternative technologies are gradually losing out (in terms of broadband subscriptions) to DSL worldwide (Cox, 2006). Whereas in 2004, cable operators and other technology providers still had a market share of 36.2%, in the first quarter of 2006 and in the first half of 2006 this figure declined to 32.8% and to 29,5% accordingly. The majority of countries present a trend in DSL broadband subscription. Although, It should be noted that in two countries (i.e. United States and Canada) cable has higher percent of the broadband market than DSL (Figure 1).

2.3. Competition in telecommunication market

Competition is driving fixed and mobile players to invest in new technologies to reduce costs and position themselves in a converged environment COM (2006).

Operators are beginning to offer portfolios of services, with different combinations of lowcost voice (including mobile), internet access and audiovisual content to attract and retain customers. After dipping significantly in 1999-2001, investment levels are recovering, with capital expenditure for the sector as a whole conservatively estimated to exceed €45 billion in the EU in 2005, an increase of approximately 6% compared to 2004 (COM, 2006).

In several European countries, the infrastructure is owned by incumbent telecommunication firms, some of which may even be state-owned. Although this practice was set in place to guarantee that the interested public is served, it may occasionally lead to additional bureaucracy and tardy adoption of technological standards. The liberalization of the local loop telecommunication infrastructure allowed the firms involved to behave more competitively and dropped broadband monthly fees to lower prices. Such an example is Sweden (Papacharissi &. Zaks, 2006).

Furthermore, competition is pushing broadband penetration as countries with more competitive markets (measured by market share of new entrants) tend to have a higher broadband penetration as well as a faster growth (ERG, 2005). In addition Aron & Burnstein (2003) find that competition between providers is an effective catalyst for increased penetration. Finally an interesting result has been extracted by Distaso, et. al (2005), who said that while inter-platform competition drives broadband adoption, competition in the market for DSL services does not play a significant role. Distaso, et. al (2005) also confirmed that lower unbundling prices stimulate broadband uptake.

2.4. Broadband access price

As far as it concerns the cost, it seems to present an important reduction the last three years, while it is strongly related to the variety and quality of provided services, as well as to the access speeds of these services. At this point it should be mentioned that cost reduction is strongly related to the level of competition of the broadband market. In cases of countries where the level of competition is low or the market is monopolistic, the cost is significantly higher, in relation to the GDP per capita. Chaudhuri & Flamm (2005) have found evidence that broadband price is indeed a statistically significant driver of broadband demand.

2.5. Broadband services

Given the fact that penetration grows, broadband providers in the OECD are increasingly offering voice and video services over this platform. The speeds offered by providers are also increasing.

To the direction of the services, multiple play offers, which include voice, data and video services, seem to prevail representing the first stage in a two-part evolution of converged ICT service delivery. This first stage has seen video, voice and data services consolidated on a given infrastructure (e.g. cable networks). The second stage will include consolidation of access platforms on one IP network, allowing users to seamlessly access content while moving over a variety of wired and wireless networks.



(a)

(b)

Figure 3: (a) Multiple play availability among OECD countries, September 2005; (b) Multiple play services by technology, September 2005 (Source: OECD)

According to OECD (2006) survey titled "Multiple Play: Pricing and Policy Trends" it appears that the services with higher supply are the following:

- Fast Internet: As it can be extracted by the survey, there is a tendency for higher access speeds. The majority of the providers begin with access speeds of 512 Kbps and there are only few that offer lower speeds. The upper level for the access speeds appears to continuously increase, reaching speeds on the order of 100 Mbps (Japan).
- Voice: The majority of the surveyed countries include voice services in their offers. Currently, these services include unlimited calls plans, while VoIP emerges to prevail in this area.
- Video: The provision of video content also constitutes one of the basic services provided in the surveyed countries. Video services are usually provided through ADSL and cable networks. To this direction, video on demand and video a la carte are the two most common services of the offers provided.

Figure 3 (a) depicts the availability of different types of multiple-play in OECD countries, while Figure 3 (b) depicts the availability of different types (by technology) of multi-play in OECD countries.

3. Factors for Supporting Broadband Growth

This section presents the main factors that affect broadband growth. Some of these factors are the following:

- The regulatory framework: The regulatory framework of telecommunications is one of the major factors that can seriously affect the broadband growth. In cases, where the regulatory framework is insufficient, the telecommunications sector may malfunction.
- The structural changes that take place in the information and communications technology (ICT) markets (e.g. increase of competition, privatization of public organizations, market liberalization, globalization, etc.).
- The changes of broadband services and of their use (e.g., VoIP, mobile telephony, 3G, WLAN, WiFi, WiMAX, digital television).
- The technological developments (e.g., creation of innovative and interoperable solutions in an IP environment, adoption of IPv6 protocol, creation of optical networks, content digitalization, increment of the computational power of personal computers, etc.).
- The users' need for fast content access. Since the demand for broadband infrastructures is led by the need for content access, both the requirements for broadband services and infrastructures are strongly interrelated.
- The affordability: one of the most important economic elements seems to be the income, compared to the cost of a broadband subscription.
- E(electronic)-readiness and in general the technological level of a country. E-readiness constitutes an essential measure of the e-business environment of a country and is defined by a collection of factors that indicate how amenable a market can be to Internet-based opportunities. Some of these factors are: a) the connectivity and technology infrastructure, b) the business environment, c) the consumer and business adoption, d) the legal, policy, social and cultural environment, etc.

3.1. Regulatory Framework

As described in Wallsten (2005) the regulations and policies should focus on removing obstacles to competition (Aron and Burnstein, 2003) and to employ subsidies targeted at encouraging investment mainly in unserved areas (Goolsbee, 2002)

Investigating the regulatory frameworks of various countries (i.e. Ireland, Germany, Australia, United States of America, Portugal, Hungary and Turkey) it can be said that the regulations should support a competitive structure of market along with the existence of bodies that will hold continuous control of competitive structure of market. These bodies should have the authorization to take the necessary measures when needed. It seems that countries that have good conditions (e.g. economically developed countries, technologically advanced countries) for a quick broadband uptake such as Ireland, US and Germany did not present the predictable broadband growth (e.g. US and Germany) or satisfactory broadband penetration rate (e.g. Ireland) due to insufficient regulatory telecommunications framework (e.g. Germany), problems in the application of regulations because of appeals (e.g. Ireland) or bad application of regulations (e.g. US).

Furthermore, the regulatory framework should include the determination of effective process of appeals in order to avoid legal uncertainty with regard to National Regulatory Authorities

(NRA) decisions, which discourages the investors in the telecommunication market. Examples of such cases constitute Germany and Ireland.

In addition, it seems that in cases where the market is not competitive enough, the NRAs should be able to impose penalties (p h. fines) that would be really avertive for incumbent operators.

In European Union (EU), the EU member states that correctly applied the EU regulatory framework for the electronic communications sector presented better broadband growth than others that don't. Examples of such cases constitute Ireland, Portugal and Hungary (Figure 4). Moreover, the independence of NRAs should be ensured, avoiding political interventions in the regulatory framework. For example, Germany presented important problems from the political intervention in the regulating environment.



Figure 4: ECTA Regulatory Scorecard 2005 (Source: ECTA)

Finally, the correlation coefficient² among the broadband penetration presented in Figure 1 and the ECTA Regulatory Scorecard (Figure 4) is 0,56. This fact denotes a strong correlation among broadband penetration and the regulatory framework.

 $^{^2}$ It should be noted that the correlation coefficient of two lists of values (in this case the regulatory scorecard and the broadband penetration) determines the relationship between the two properties. Although no causality can be implied among these properties, it is an indication about their relationship.

3.2. Financial, Social and Geopolitical Factors

This paragraph presents briefly the relation between the broadband growth and financial, social and geopolitical factors. These factors could be general for a country such as the Gross Domestic Product (GDP), the GDP distribution in primary, secondary and tertiary sector and the GDP per capita. Other elements could be special for a citizen such as the education level, the familial situation, the place of stay etc.

Summarizing data for the general elements (GDP and the distribution of GDP in primary, secondary and tertiary sector), but also the special elements for the broadband users important conclusions can be extracted.

In particular, it seems that there is a cross-correlation between GDP per capita and broadband penetration. On the one hand, countries with high GDP per capita (such as Finland, Denmark and USA) present high broadband penetration. On the other hand, countries with low GDP (such as Greece, Turkey and Hungary) present low broadband penetration. However, there is no one-to-one equivalence, as there are countries with very high GDP per capita (such as Ireland) that do not present very high broadband penetration. There are also differentiations in countries with almost the same GDP per capita (such as Greece and Portugal) that have different broadband penetration. These differentiations are mainly owed in the purchasing power that differs from country to country, in the cost of broadband subscription and in the different broadband strategies of each country. These conclusion is confirmed by the data presented in Figure 5 that shows the simple correlation (=0,596) between the broadband penetration and GDP per capita in the OECD countries.



Figure 5: OECD broadband penetration and GDP per capita (Source: OECD, 2006)

Finally the correlation co-efficient between broadband penetration (in December 2005) and the monthly DSL access cost in OECD member states (for speeds of at least 512 Kbps and free data of at least 1 Gbyte, November 2004) is about -0,507 (Figure 7). This fact denotes that there is a strong relation between the broadband access cost and the broadband penetration. It also denotes that the cheaper the broadband access the higher the broadband penetration.



Figure 6: Broadband penetration and monthly cost per Kbps of access speed in PPP USD

Thus, we understand that affordability is an important determinant. This result is also supported by Chaudhuri & Flamm (2005). In order to compare the affordability of various countries we define as annual affordability, the product of:

[the amount of Kbps that can buy a user with 1 USD³] * [the GDP per capita⁴]

This amount is normalized in PPP so it can be used for comparisons among various countries. Moreover, based on EUROSTAT's data, it appears that the broadband and Internet use by domestic users is differentiated depending on the educative level, the familial situation, the age, the place of stay, the economic situation and the work type. On the contrary, sex does not appear to play some role.

More particularly the households with children allocate in bigger percentage broadband connection from the households that do not have children. Still, the young persons and more general the persons among 24-54 years old constitute the majority of Internet users.

Moreover, higher educative level implies higher Internet use. Concerning the type of work, we can say that the majority of students are Internet users, while follow the workers and finally the unemployed.

These statements are supported by the findings of Chaudhuri & Flamm (2005), who said that "there is a strong correlation between race, age, and levels of income and education, and access decision". According to them the "digital divide" is correlated with these factors, and that the poor, the less educated, and non-whites are on the disconnected side of the divide.

³ United States Dollars, calculated in PPP

⁴ InUSD calculated in PPP



Figure 7: OECD broadband penetration and population densities

Flamm (2005) finds that geographic terrain, income and population density are important determinants of broadband penetration. Furthermore, concerning the population density in an area, we can say that regions with low population density have smaller broadband penetration compared with semi-urban and urban regions. However, according to Figure 7, we can say that there is no strong correlation between population density and the broadband penetration in a country.

Moreover, even if the geographic terrain, population density, race, and age important determinants of broadband penetration in an area we propose to no take them into account when we are searching for best practices world wide. The reason is that all these factors are characteristics of a country but not results of a practice/policy of a country.

3.3. Technological Level

Concerning the technological level of a country in ICT, some of the main factors that should be measured are: a) the connectivity and technology infrastructure, b) the business environment, c) the consumer and business adoption, d) the legal, policy, social and cultural environment, etc. Main indices that take into account the above factors and have been investigated are the following:

- International Telecommunication Union's (ITU) Digital Access Index (DAI).
- Networked Readiness Index of World Economic Forum.
- E-readiness ranking of Economist Intelligence Unit.

Figure 8 presents the ranking of some countries concerning these indices.



Figure 8: Indices DAI, e-readiness and NRI

Furthermore, Figure 9 presents the simple correlation of 26 countries rank concerning broadband penetration and the indices DAI, e-readiness and NRI.

It seems that there is a strong correlation between these indices and the broadband penetration for many countries. For example Greece is at the last rank (26th) concerning the broadband penetration and it is also in the last places of classification of indices DAI (20th rank), e-readiness (21st rank) and NRI (24th rank).



Figure 9: Simple correlation of the countries rank concerning broadband penetration and the indices DAI, e-readiness and NRI

Furthermore, it can be noticed that Internet penetration is an important factor that affects broadband penetration. Based on data presented in Figure 1, it can be calculated that the correlation co-efficient between broadband penetration and Internet penetration is about 0.83. This means that countries with low Internet use have low probability to present a high broadband penetration growth.

4. Definition of Best and Good Practice Index

Based on the factors presented in the previous section, this section aims at quantifying the above factors and defining two new indices: (a) the Best Practice Index (BPI), which indicates that a country followed some of the best practices worldwide for supporting its broadband growth, and (b) the Good Practice Index (GPI), which, accordingly, indicates that a country followed some of the good practices worldwide for supporting its broadband growth. In this section the criteria, their sources, and the indices are presented.

4.1. Criteria

The first step of the methodology is to select the main criteria that could be used for defining the above indices. Based on the discussion in previous sections (i.e. sections 2 and 3) these criteria are the following:

- The affordability of a user to buy broadband expressed by the Kbps per United States Dollars (USD, calculated in PPP) times the GDP per capita. We refer to this criterion as "A". Thi criterion has been presented in more detail in paragraph 3.1.
- Annual average growth rates of Gross Domestic Product (GDP) per hour worked. This criterion is referred as "B". This criterion has been adopted because the growth of GDP could affect the affordability of the users in a country.
- The Economist Intelligence Unit's e-readiness rankings. This criterion is referred "C". This criterion has been adopted in order to express the technological level of each country. The e-readiness rankings are a weighted collection of nearly 100 quantitative and qualitative criteria, organised into six distinct categories measuring the various components of a country's social, political, economic and of course technological development. The underlying principal behind the rankings is that digital business is at its heart business, and that for digital transactions to be widely adopted and efficient, they

have to thrive in a holistically supportive environment. E-readiness is not simply a matter of the number of computer servers, websites and mobile phones in the country, but also such things as its citizens' ability to utilise technology skillfully, the transparency of its business and legal systems, and the extent to which governments encourage the use of digital technologies. As discussed in paragraph 3.3 before. E-readiness strong correlation between these indices and the broadband penetration.

- The broadband penetration growth rate. We refer to this criterion as "**D**". This criterion could be regarded as the main indication concerning the probability of a country to present high broadband penetration in future or not.
- Broadband subscribers per 100 inhabitants. This criterion is defined as "E". This criterion
 has been adopted in order to express the current state of a country concerning broadband
 penetration.
- Internet subscribers per 100 inhabitants. This criterion is referred as "F". Internet subscribers are implicitly broadband subscribers. For that reason this criterion has been adopted.
- The Internet penetration growth rate. This criterion is called "G". This criterion could be regarded as the main indication concerning the probability of a country to present high Internet penetration in future or not.
- The investment in information and communication technologies (ICT): This criterion is the percentage of non-residential gross fixed capital formation, total economy and is referred as "H". This criterion has been adopted in order to express the possibility of a country to improve its technological level.
- The level of competition in telecommunications sector. This criterion is called "I". This criterion has been adopted in order to express the possibility of the broadband market in a country to present lower broadband access prices and thus to increase the affordability of the potential users.

We can categorize the above criteria in three basic categories. The first category contains technological criteria such as D, E, F, and G. The second category contains financial criteria such as A, H and I. Finally, the third category contains social criteria such as B and C.

4.2. Data sources

For quantifying the above criteria the sources used for each criterion are presented. (It should be noted that data for all the above criteria were available for the following countries: Australia, Austria, Belgium, France, Germany, Denmark, Greece, US, Japan, Ireland, Spain, Italy, Canada, Rep. of Korea, United Kingdom, New Zealand, Norway, The Netherlands, Portugal, Sweden, and Finland):

 Criterion "A": The data for the cost concern Internet access by DSL in OECD member countries, including tax, in November 2004 (apart from The Netherlands, Belgium, United Kingdom, Austria, Germany, Portugal, Ireland and New Zealand, for which the available data apply for 2002)(OECD, 2005). The affordability were calculated as:

GDP per capita * [Monthly cost (USD PPP)/Speed of connection downstream (kbit/s)]

- Criterion "**B**": The data concern the Annual Average Growth Rates during 2000-2004 and based on GDP per hour worked. These data have been drawn from OECD productivity database.
- Criterion "C": These data concern the 2005 e-readiness score and they were drawn from the report «The 2005 e-readiness rankings, a white paper from the Economist Intelligence Unit» (E-readiness, 2005).

- Criterion "D": The data concern the broadband penetration growth rate during 2002-2005 and are based on OECD (2005b).
- Criterion "E": The data concern the broadband penetration at June 2005 and they based on OECD (2005b).
- Criterion "F": The data concern the Internet penetration at June 2005 and are based on Internet World Stats (2006).
- Criterion "G": The data concern the Internet penetration growth rate during 2000-2005 and are based on Internet World Stats (2006).
- Criterion "H": The data concern the ICT investment by asset in OECD countries, 2003 (2002 for Australia, France, Japan, New Zealand, Norway and Spain; 2001 for Italy) and present the percentage of non-residential gross fixed capital formation in the total economy. ICT equipment is defined here as computer and office equipment and communication equipment; Software includes both purchased and own account software. Software investment in Japan is likely to be underestimated, due to methodological differences.
- Criterion "I": The data used for the level of competition in telecommunications sectors were drawn form ITU World Telecommunication Regulatory Database (http://www.itu.int). The level of competition in each country has been calculated as the average of the level of competition in each sector.

The sectors are the following: Local services, Domestic long distance, International long distance, Wireless local loop, Data, DSL, Cable modem, VSAT, Leased lines, Fixed Wireless Broadband, Mobile, Paging, Cable TV, Fixed sat, Mobile satellite, GMPCS, IMT 2000, Internet services, and International gateways.



Figure 10: Level of competition in telecommunications

The level of competition in each sector is denoted as:

- 0, in case of monopoly
- 1, in case of duopoly
- 2, in case of partial competition
- 3, in case of full competition

According to the above we resulted to Figure 10.

4.3. Indices

Based on the above criteria, we used the following equation for defining both the Best Practice Index (BPI) as well as the Good Practice Index (GPI):

Score=
$$W_A^*(A) + W_B^*(B) + W_C^*(C) + W_E^*(E) + W_F^*(F) + W_H^*(H) + W_I^*(I)$$
 (1)

Where:

- (A), (B), (C), (E), (F), (H), and (I) are the normalized values (in a range of 1 to 10) for the values of criteria A, B, C, E, F, H, and I respectively.
- W_{A} , W_{B} , W_{C} , W_{E} , W_{F} , W_{H} , W_{I} , are the weights assigned to each factors/criterion.

It should be mentioned that equation (1) does not take into account indicators D and G. If both these factors have been taken into account in equation (1), then we would subsidize the countries with minimal broadband penetration in 2003 and minimal Internet penetration in 2000, even though they have not presented a good rate of broadband and Internet penetration. Both indicators D and G are taken into account in the Good Practice Index, as explained later in this section.

According to the above we define as Best Practice Index (BPI) the following:

 $BPI = AV(S_1, \dots, S_n) + SW$ ⁽²⁾

where:

- S_i is the *Score* of a country
- $AV(S_1,...,S_n)$ is the average of $S_1,...,S_n$
- n is the number of countries
- the SW is the sum of weights assigned to each actor (i.e. $W_A+W_B+W_C+W_E+W_F+W_H+W_I$), which is the number of criteria and it is used as a threshold.

The equation (2) means that a country with *Score* bigger than BPI (*Score*_{*i*} >=*BPI*) could be regarded as best practice.

Furthermore, we define as Good Practice Index (GPI) the following:

$$\mathbf{GPI} = \mathbf{AV}(\mathbf{S}_{1},\dots,\mathbf{S}_{n}) \tag{3}$$

where S_i is the *Score* of a country and $AV(S_1,...,S_n)$ is the average of $S_1,...,S_n$ A country_i could be regarded as good practice when:

$$S_i \geq = GPI \&\& Di + Gi \geq AV(D_1, \dots, D_n) + AV(G_1, \dots, G_n)$$
(4)

where $AV(D_1,...,D_n)$ is the average of $D_1,...,D_n$ and $AV(G_1,...,G_n)$ is the average of $G_1,...,G_n$

The equation (4) indicates that we can consider as good practices the practices of countries with score higher than the average score and furthermore present a rapid growth of broadband and Internet penetration (criteria D and G respectively).

4.4. Weights

In order to decide about the weights that should be assigned to each factor in equation (1), the following procedure has been followed:

- Step 1: Collection data for each factor for each country (as described in the previous paragraphs)
- Step 2: Calculation of S_i for each country using different weights for each factor and extraction of the countries that could be regarded as best (or good) practices. More specifically we have calculated S_i for each country by changing each weight in a scale 1 to 6, while keeping the rest of weight fixed (=1).
- Step 3: Selection of the most suitable weights of each factor based on the results of step 2. observation of the

The steps 2 and 3 are described in the following paragraphs.

4.4.1. Step 2

In step 2 we have calculated Si for each country by changing each weight in a scale 1 to 6, while keeping the rest of weight fixed (=1). In parallel we have calculated the BPI and GPI for each case as well as which countries could be regarded as best practice.

The results of this step are presented in Table 1:

- The first column of Table 1 lists the countries
- The rest of columns in Table 1 present the results of equation (1) listing as B or G the countries that could be regarded as best or good practices respectively.
- The 2nd column of Table 1 presents the results of equation (1) by having $W_A = W_B = W_C = W_E = W_F = W_H = W_I = 1$.
- The columns 3 to 7 of Table 1 present the results of equation (1) by changing W_A from 2 to 6 and keeping W_B=W_C=W_E=W_F=W_H=W_I=1.
- The columns 8 to 12 of Table 1 present the results of equation (1) by changing W_B from 2 to 6 and keeping W_A=W_C=W_E=W_F=W_H=W_I=1.
- The columns 13 to 17 of Table 1 present the results of equation (1) by changing W_C from 2 to 6 and keeping W_A=W_B=W_E=W_F=W_H=W_I=1.
- The columns 18 to 22 of Table 1 present the results of equation (1) by changing W_E from 2 to 6 and keeping W_A=W_B=W_C=W_F=W_H=W_I=1.
- The columns 23 to 27 of Table 1 present the results of equation (1) by changing W_F from 2 to 6 and keeping W_A=W_B=W_E=W_C=W_H=W_I=1.
- The columns 28 to 32 of Table 1 present the results of equation (1) by changing W_H from 2 to 6 and keeping W_A=W_B=W_E=W_F=W_C=W_I=1.
- The columns 33 to 37 of Table 1 present the results of equation (1) by changing W_I from 2 to 6 and keeping W_A=W_B=W_E=W_F=W_H=W_C=1.
- The last column of Table 1 presents how many times (in percentage) each country has been calculated as good or best practice.
- The last row of Table 1 presents how many times (in percentage) each weight has been contribute to the calculation of a country as good or best practice.

| | WITHOUT WEIGHTS | ALT | ERA | TION | OF | WB | ALTERATION OF WB ALTERATION OF WC | | | | | | | ALTERATION OF WE ALTERATION OF WE | | | | | | | | WF | ALT | ERA | TION | OF | WH | ALTERATION OF WI | | | | WI | | | | | |
|-------------|-----------------|-----|-----|------|----|----|-----------------------------------|---|---|---|---|---|---|-----------------------------------|---|---|---|---|---|---|---|----|-----|-----|------|----|----|------------------|---|---|---|----|---|---|---|---|-------|
| WA | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| WB | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| WC | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| WE | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| WF | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| WH | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 1 | 1 | 1 | 1 | |
| Ŵ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | ×. |
| Australia | | | | | | | | | | | | | | | | | | | | | | | | | | | G | G | G | G | G | | | | | | 14% |
| Austria | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0% |
| Belgium | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0% |
| Canada | | | В | B | в | B | | | | | | | | | | | в | B | B | В | в | | | в | В | В | | | | | | | | | | | 33% |
| Denmark | | | | | | | | | | | | | | | | | в | Ð | B | B | в | | | | | | | | | | | | | | | | 14% |
| Finland | | | | | | | | | | | | | В | в | в | в | | B | B | B | В | | | | | | В | В | В | В | в | | | | | | 36% |
| France | | | | | | | | | G | G | | | | | | | | | | | | | | | | | | | | | | | | | | | 6% |
| Germany | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0% |
| Greece | | | | | | | | | G | G | В | | | | | | | | | | | | | | | | | | | | | | | | | | 8% |
| Ireland | | | | | | | G | G | В | B | В | | | | | | | | | | | | | | | | | | | | | | | | | | 14% |
| Italy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0% |
| Japan | B | В | В | В | В | B | В | | | | | | | | | | В | В | В | | | В | | | | | | | | | | В | В | | | | 36% |
| Korea | B | В | В | В | В | B | В | В | В | В | В | В | В | В | В | В | В | В | В | В | В | В | в | в | В | В | В | В | В | В | В | В | В | В | в | в | 100% |
| N. Zealand | | | | | | | | | | | | | | | | | | | | | | | | | | G | | | | | | | | | | | 3% |
| Netherlands | | | | | | | | | | | | | G | G | G | G | G | G | В | В | В | G | G | G | G | G | | | | | | | | | | | 39% |
| Norway | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0% |
| Portugal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0% |
| Spain | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0% |
| Sweden | B | | | | | | B | В | B | B | | B | B | B | B | B | | | | | | В | в | B | B | B | B | B | В | B | B | | | | | | 56% |
| UK | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | G | | | 94% |
| USA | B | В | В | В | В | B | В | В | В | В | В | В | В | В | В | В | В | B | B | B | в | В | В | в | В | В | В | В | В | В | В | В | В | В | В | В | 100 % |

Table 1: Step 2 results

4.4.2. Step 3

Concerning the data presented in Table 1, we can make the following observations:

- "Observation 1": Based on the last column of Table 1, some countries are almost always calculated as good or best practice (Table 1-Last Column). These countries are Korea, UK and USA.
- "Observation 2": Sweden (by 56%), the Netherlands (by 39%), Japan (by 36%), Finland (by 36%), and Canada (by 33%) are the countries that are most frequently calculated as good or best practices.
- "Observation 3": Some countries are calculated as best (or good) practices only when a specific weight is altered. The most significant case concerns France, Greece and Ireland during the alteration of W_B. In this case, we can say that equation (1) is conversely affected by the factor B, due to the fact that the increment of the weight of this factor creates reverse results.
- "Observation 4": Based on the data presented in the last row of Table 1, factor (E) affect the calculation of the 35% (in average) of countries as best (or good) practices. The factors (A), (C), (F), (H) have affected the calculation of the 23%-29% (in average) of countries as best (or good) practices. The factor (I) has affected the calculation of the 14% (in average) of countries as best (or good) practices.

Based on the above observations we propose to consider factor E (that is the broadband penetration) to have high importance. This is quite logical as it is considered as the most indicative factor for the calculation of the best practices for the broadband growth. Therefore, we multiply this factor by 3 (W_E = 3).

Furthermore, factors A, C, F, and H could be considered to have equal (among them) importance to the broadband penetration growth. However and based on "observation 4", we consider that these indicators have lower importance than indicator E and higher than indicator I. Therefore, $W_A = W_C = W_F = W_H = 2$ and $W_{EI} = 1$.

Based on "observation 3" indicator B have lower importance than factors A, C, F, and H. This is quite logical as it is considered as a depended factor and therefore it is assigned with weight 1 (W_B = 3).

Thus the equation (1) could be changed to equation (5).

 $Score = 2^{*}(A) + (B) + 2^{*}(C) + 3^{*}(E) + 2^{*}(F) + 2^{*}(H) + (I)$ (5) In the rest of the paper we are calculating both BPI and GPI based on equation (5).

5. Best Practice Analysis

This section presents the results of the calculation of best practices and discusses them.

5.1. Calculation of best practices

Based on the equations (2), (4) and (5) we calculated the *Score* for each country.

| Country | (A) | (B) | (C) | (D) | (E) | (F) | (G) | (H) | (I) | Score | Result | | | | |
|-------------|-----|------------|-----|------------|------------|------------|-----|-----|------------|-------|---------------|--|--|--|--|
| Korea | 4 | 10 | 9 | 0 | 10 | 9 | 2 | 5 | 10 | 102 | Best Practice | | | | |
| USA | 2 | 6 | 10 | 1 | 6 | 9 | 4 | 10 | 10 | 98 | Best Practice | | | | |
| Japan | 10 | 5 | 8 | 1 | 6 | 8 | 2 | 4 | 10 | 93 | Best Practice | | | | |
| Canada | 3 | 4 | 9 | 0 | 8 | 9 | 3 | 6 | 10 | 92 | Best Practice | | | | |
| Denmark | 1 | 4 | 10 | 1 | 9 | 9 | 3 | 6 | 9 | 92 | Best Practice | | | | |
| Sweden | 0 | 6 | 10 | 1 | 6 | 10 | 2 | 8 | 10 | 90 | Best Practice | | | | |
| Finland | 0 | 6 | 10 | 2 | 7 | 8 | 2 | 8 | 10 | 89 | | | | | |
| Netherlands | 1 | 2 | 9 | 2 | 9 | 9 | 6 | 5 | 8 | 85 | Good Practice | | | | |
| Belgium | 3 | 4 | 9 | 1 | 7 | 6 | 5 | 6 | 9 | 82 | | | | | |
| Norway | 1 | 6 | 9 | 2 | 7 | 9 | 1 | 4 | 9 | 82 | | | | | |
| UK | 1 | 6 | 10 | 4 | 5 | 8 | 5 | 7 | 9 | 82 | Good Practice | | | | |
| Austria | 1 | 4 | 9 | 1 | 5 | 9 | 4 | 4 | 10 | 75 | | | | | |
| Australia | 0 | 5 | 9 | 4 | 4 | 7 | 4 | 7 | 10 | 73 | | | | | |
| Germany | 1 | 4 | 9 | 1 | 4 | 8 | 4 | 5 | 10 | 72 | | | | | |
| France | 1 | 6 | 9 | 3 | 5 | 6 | 7 | 4 | 10 | 71 | | | | | |
| Ireland | 1 | 10 | 9 | 10 | 2 | 7 | 6 | 2 | 10 | 64 | | | | | |
| Portugal | 0 | 2 | 8 | 2 | 4 | 8 | 5 | 4 | 10 | 64 | | | | | |
| Italy | 1 | 1 | 8 | 4 | 4 | 6 | 4 | 5 | 10 | 63 | | | | | |
| Spain | 0 | 3 | 8 | 2 | 4 | 5 | 8 | 4 | 10 | 59 | | | | | |
| N. Zealand | 0 | 3 | 4 | 2 | 3 | 10 | 10 | 4 | 10 | 58 | | | | | |
| Greece | 0 | 10 | 7 | 5 | 0 | 4 | 10 | 3 | 9 | 47 | | | | | |

Table 2: Best practices results

The average score is 78. Table 2 presents the following info for each country:

- The normalized values for each criterion [i.e. (A), (A), (B), (C), (E), (F), (H), and (I)]
- The Score

• The Result, (i.e. "Best Practice" or "Good Practice").

According to the data presented in Table 2 the practices of the following countries raised as **best practices**:

- Denmark
- United States
- Japan
- Canada
- Rep. of Korea

Sweden

Furthermore, the practices of United Kingdom and the Netherlands came up as good practices.

The higher *Score* is achieved by Rep. of Korea, while the lower *Score* is achieved by Greece (Figure 11).

A considerable result is that Norway, Belgium and Finland are not presented as best practices neither as good practices, although their score is higher than the average score (89, 82 and 82 respectively).

However, this can be explained by the value of indicators D and G for these countries, which indicate that they presented small broadband and Internet presentation growth rates. In other words, we can say that there is a maturation concerning broadband growth in these countries. Therefore, these countries are not considered as best practices.

Comparing the results of Table 2 with ECTA Regulatory Scorecard 2005 (Figure 4), there is a relation between the effectiveness of the telecommunication regulation frameworks and the Score in Table 2. For example the practices of Denmark and UK, which constitute best and good practices respectively, present a high score in the Regulatory Scorecard 2005 as well.

Moreover, Germany and Greece that both appear with low Scores in Table 2 (85 and 56 respectively), they also present low scores (220 and 218 respectively) in the Regulatory Scorecard 2005.



Figure 11: Best practices ranking

5.2. Discussion

Investigating the broadband strategies in the above countries (Denmark, Sweden, United States, Japan, Canada, Korea United Kingdom and the Netherlands) and analyzing them, basic results can be extracted for the policies and practices that could be followed by a country for increasing its broadband growth.

The governments of the above countries articulated a vision of what ICT could do for both public and private sectors' beneficiaries. Furthermore, the policies and strategies adopted by these countries for supporting the broadband growth aimed at:

• The improvement of users' dexterities in ICT: United Kingdom, Republic of Korea and Japan adopted this action for supporting the broadband growth. For example in Republic of Korea the government has provided computer literacy training and education aimed at elementary and middle schools, housewives, the military, and the disabled. A major

Korean initiative in this area has been the three-year "10 Million People IT Education project", which was launched in mid-2000. A similar action in Japan is "IT Human Resource Development Plan".

- The Internet penetration growth: Most of the countries aim at the growth of Internet use, mainly in rural areas. For example, the Community Access Program (CAP) in Canada aims at establishing free Internet access points in schools, hospitals and other public centers.
- Tax exemptions/Loans: Many countries include in their policies and strategies, tax exemptions for enterprises or citizens who want to use ICT. Examples are Korea, Denmark and United States. In US, the largest Federal program supporting broadband development in rural and remote areas is the Federal Rural Broadband Access Loan and loan Guarantees Program where 1.4 billion US \$ in loans and loan guarantees have been made available on Federal level to provide broadband services in rural areas. Denmark has introduced a special taxation scheme, which enables employers to offer PCs as well as broadband connections to their employees as a tax free benefit. Considering the high levels of income taxes in Denmark, this implies that tax reductions in reality pay more than 50% of the costs. This scheme has become very popular and many companies provide this opportunity to all of their employees as part of their salary.
- Development of broadband infrastructures and coverage of rural areas: Almost all countries aim at the development of broadband infrastructures either for increasing the broadband supply in general or for creating new infrastructures in rural and underserved areas. For example in Canada one of the most important initiatives is the Broadband for Rural and Northern Development Pilot (BRAND) Program which aim at connecting underserved areas and unconnected communities.
- Development broadband services: Many countries aim at the development of broadband services for supporting e-health, e-government, and electronic public services in general. Furthermore, some countries aim at the increment of use of e-services in the public sector. For example in UK the Government together with industry plans to sponsor a "Digital Challenge" prize for a local authority and its partners both public and private to establish by 2008 universal access, advance public service delivery and provide a test-bed for best practice in e-government.
- Improvement of the security of broadband connection/services: Some of the above countries (i.e. UK and Japan) aim at improving the security on broadband connection/services. The UK's digital strategy aims at making the "UK the safest place to use the Internet".
- **Revision of the regulatory framework**: Almost all countries include regulation measures in their broadband strategies. The main reason is to support the competition. The best practice in this area has been adopted by UK, which presents the highest score in ECTA Regulatory Scorecard 2005 (Figure 4). The regulatory strategy in UK is set out by Ofcom, which has a duty to ensure that a wide range of electronic communications services including high speed data services– is available throughout the UK. Ofcom has indicated that by the end of 2007/8, its "aim is to have encouraged the development of an environment in which there is much more competition and innovation in broadband networks and services".
- **Broadband content development and digitization**: Almost all countries include broadband content development and digitization regulation measures in their broadband strategies. For example in UK, the Government aims at allowing people to use or reach any content, with any device, anywhere, anytime. According to the UK Government,

content, whether as a business tool, for entertainment, a community portal, e-learning or generated by consumers themselves, is key to driving up the effective use of ICT. Through the DTI's Technology Programme, the UK Government is already providing funding to encourage innovation and research in developing broadband content.

- Supporting of synergies between private-public sector: Almost all countries support the synergies of private - public sector for increasing the broadband growth and to create or exploit broadband infrastructures. For example, the Dutch Government takes the view that municipal and provincial authorities and housing corporations can play an important and useful role in the development of broadband, in partnership with market parties. Also in Japan, the Government emphasized that the private sector had to be the driving force, with the government limited to establishing the right framework for the private sector and to the non-private sectors (e-government, R&D and overcoming the digital divide). In spite of this, the central Japanese government, actually, supports roll-out of broadband facilities by offering attractive financing schemes, tax incentives and guarantee of liabilities.
- Financing of research projects: Many countries (such as UK and the Netherlands) provide funding to encourage innovation and research in developing broadband. As already referred UK Government is providing funding developing broadband content. Also in Netherland "Kenniswijk" and "Broadband in Four Social Sectors" are the most funded projects (€ 9 000 000 and € 2 400 000 respectively).
- Bridging the Digital Divide: Some counties (such as UK, Korea, and Canada) aim at providing access to underserved areas and people with disabilities in order to close the digital divide. For example in UK one of the main actions in UK's digital strategy is to "improve accessibility to technology for the digitally excluded and ease of use for the disabled." One of the measures is the building of UK online Centres. Furthermore in Korea the Korean Digital Divide Act was established in 2001 and revised in 2002 (BREAD 2005). It generated the five-year master plan for closing the digital divide, annual action plans, the "Digital Divide Closing Committee," and launched the Korean Agency for Digital Opportunity and Promotion (KADO). The 2004 annual action plan consisted of constructing high-speed information network in rural areas, supporting assistive technologies for disabled people, constructing 80 Internet access centres, recycling of PCs and Digital TVs to disabled and non-profit organizations, and providing IT education. KADO also developed content for disabled and the elderly, and engaged in international projects that aimed at closing the digital divide. Korean policies also included 30 to 50 % discounts in telecommunication service charges to low-income and disabled users.

6. Conclusion

This paper presented a methodology for locating the countries that followed best practices for increasing their broadband growth. According to this methodology the paper showed that Denmark, United States, Japan, Canada and Rep. of Korea followed best practices for their broadband growth. Furthermore, it appears that United Kingdom and the Netherlands followed best practices for their broadband growth. Investigating the broadband strategies in the above countries and analyzing them, the main result is that the governments of the above countries articulated a vision of what ICT could do for both public and private sectors' beneficiaries. Furthermore, the policies and strategies adopted by these countries targeted at (1) the improvement of users' dexterities in ICT; (2) supporting the Internet penetration growth; (3) supporting the ICT use by tax exemptions and loans; (4) the development of

broadband infrastructures and coverage of rural areas; (5) the development broadband services; (6) the revision of the regulatory framework; (7) the support of synergies between private-public sector; (8) the funding of research projects; (9) the bridging of the Digital Divide; (10) the improvement of the security of broadband connection/services; (11) the uptake of regulation measure and (12) the development of broadband content.

These results are in line with Frieden (2005). In particular, the cooperation of the private and public sector is of critical importance for the ICT development, where both types of sectors undertake roles that maximize the benefits. Nat ions achieving comparatively greater success in ICT development demonstrate the value in having a specific mission, achievable goals and policies designed to achieve success. The lessons learned by these countries could be followed by other countries with low broadband penetration or they could be used as a guide by the countries with low score in Best Practice Index, such as Greece (Alexiou et al., 2005). Our next step is to verify our methodology, based on the new data concerning the factors

our next step is to verify our methodology, based on the new data concerning the factors presented in this paper (i.e. broadband penetration in 2006, etc.)

7. References

Alexiou, A., Bouras, C., Igglesis, V., Kapoulas, V., Paraskevas, M., Tsiatsos, T., and Papagiannopoulos, J. (2005) The Broadband Status in the Region of Western Greece: Overview and Recommendations. Broadband Europe 2005, Bordeaux, France, 12 - 14 December.

Aron, D. & Burnstein S. (2003). Broadband Adoption in th United States: An empirical Analysis. SSRN

BREAD (2005). Broadband for all. Deliverable D22-D32 of BREAD project. Available at: http://www.ist-bread.org/

COM (2006). Communications Regulation And Markets 2005 (11th Report). Communication from the Commission to the Council, The European Parliament, The European Economic and Social Committee and the Committee of the Regions. European Electronic Commission Of The European Communities Brussels, 20.2.2006. Available at

<u>http://europa.eu.int/information_society/policy/ecomm/doc/implementation_enforcement/annualreports/11threpo</u> <u>rt/com_2006_68_en_final.pdf</u>. (last visited 11/1/2007)

Cox, T. (2006). World Broadband Statistics: Q1 2006, Point Topic Ltd, June 2006E-readiness (2005). The 2005 e-readiness rankings, A white paper from the Economist Intelligence Unit, available at http://graphics.eiu.com/files/ad_pdfs/2005Ereadiness_Ranking_WP.pdf (last visited 10/6/2006)

Distaso, W., Lupi, P., Manent F. (2005). Platform Competition and Broadband Uptake: Theory and Empirical Evidence from the European Union. LBS 2005 telecommunications conference

ECTA Regulatory Scorecard (2005). Edited by Jones Day and SPC Network for ECTA. Available at http://www.ectaportal.com/en/upload/File/Regulatory%20Scorecards/Scorecard280406/Scorecard%202005.zip (last visited 10/6/2006)

ECTA Regulatory Scorecard (2006) Edited by Jones Day and SPC Network for ECTA (11/12/2006). Available at

http://www.ectaportal.com/en/upload/File/Press%20Releases/2006/Press%20Release%20Regulatory%20scoreca rd%2011%2012%2006.pdf (last visited 11/1/2007)

ECTA Regulatory Scorecard (2005). (U.S. Annex) Edited by Jones Day and SPC Network

ERG (2005). ERG Broadband market competition report (Full Report).

Flamm, K. (2005). "The role of Economics, Demographics and State Policy in Broadband Availability". LBJ School of Public Affairs: Austin, TX.

Flamm, K., Chaudhuri, A. (2005). An Analysis of the Determinants of Broadband Access. October 2005. Presented at the Telecommunications Policy Research Conference Washington, DC, September 24, 2005.

Frieden, R., (2005). Lessons from broadband development in Canada, Japan, Korea and the United States. doi:10.1016/j.telpol.2005.06.002, 2005 Elsevier Ltd

Goolsbee, A. (2002). "Subsidies, the value of broadband and the Importance of fixed costs", in Broadband: Should we regulate high-speed Internet Access? Robert Crandall and James Alleman eds. Washington, DC: Brookings Institution Press.

Internet World Stats (2006) Internet World Stats. Available at http://www.internetworldstats.com (last visited 10/6/2006)

Mueller, K. (2006). World Broadband Statistics: Q4 2005, Point Topic Ltd, March 2006

Papacharissi, Z., Zaks, A. (2006). Is broadband the future? An analysis of broadband technology potential and diffusion. Telecommunications Policy 30 (2006) 64–75 70.

OECD (2005). OECD Communications Outlook 2005.

OECD (2005a). OECD productivity database, July 2005. Available at http://www.oecd.org/dataoecd/30/14/29861140.xls (last visited 10/6/2006)

OECD (2005b). OECD Broadband Statistics, June 2005, http://www.oecd.org/document/16/0,2340,en_2649_33703_35526608_1_1_1_1_00.html (last visited 10/6/2006)

OECD (2006a). Multiple Play: Pricing and Policy Trends. Available at: http://www.oecd.org/dataoecd/47/32/36546318.pdf

OECD (2006). OECD Broadband Statistics, December 2005, http://www.oecd.org/document/39/0,2340,en_2649_33703_36459431_1_1_1_1_00.html (last visited 10/6/2006)

OECD STI Scoreboard (2005) OECD Science, Technology and Industry: Scoreboard 2005 (D. ICT: an enabler for the knowledge society, D.1. Investment in ICT equipment and software) ISBN 92-64-01056-4, © OECD 2005. Available at: http://puck.sourceoecd.org/vl=3259653/cl=22/nw=1/rpsv/scoreboard/data/d01.xls (last visited 10/6/2006)

Wallsten S. (2005). Broadband Penetration: An empirical Analysis of State and Federal Policies. Working Paper 05-12. Joint Center (AEI-BROOKINGS JOINT CENTER FOR REGULATORY STUDIES), June 2005.