JRC Technical Notes

East Asian Growth:
Broadband: Lessons from Asia

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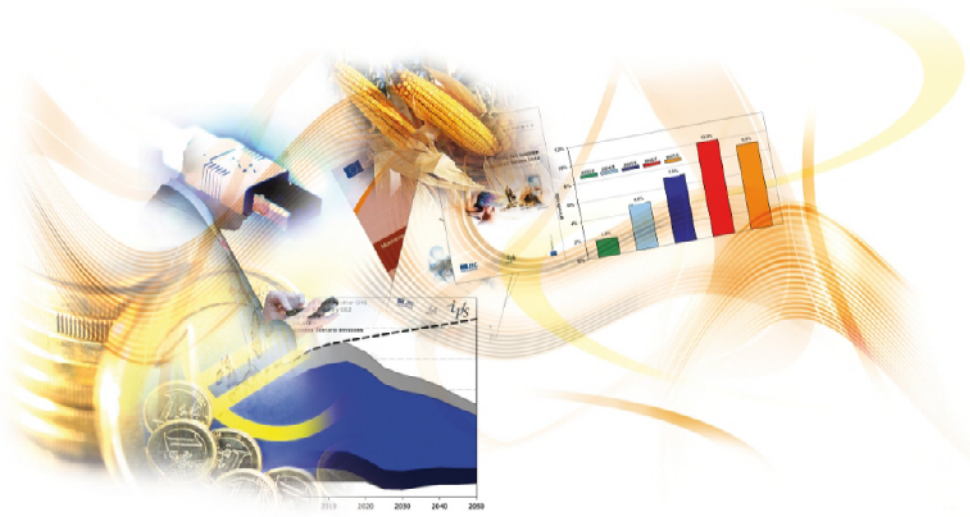

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Preface

R&D activity in the Information and Communication Technologies (ICT) industrial sectors is an important factor in boosting the competitiveness of the European economy. The ICT industry and ICT-enabled innovation in non-ICT industries and services is making an increasingly important contribution to economic growth in advanced economies. The ICT sector was highlighted in the EU Lisbon Objectives, and has retained its prominence in the recently proposed **Europe 2020 Strategy**.

The Information Society Unit at IPTS[1] is carrying out a research project on Prospective Insights on R&D in ICT (PREDICT)[2] and has produced a series of annual reports. PREDICT combines, in a unique way, three complementary perspectives: national statistics (covering both private and public R&D expenditures), company data, and technology-based indicators. PREDICT relies on the latest available official statistics delivered by Member States, Eurostat and the OECD.

The first part of each annual PREDICT report gathers the most recent quantitative information on ICT R&D investments in the EU and worldwide. It presents the data by countries, sub-sectors and companies. The second part of each report is dedicated to a specific thematic analysis. In 2010, it focused on the internationalisation of ICT R&D.

This thematic analysis is based, in part, on an earlier study which focused on the ICT sector and R&D in East Asian countries in order to gain a better understanding of major ICT capabilities in those parts of the world.[3] The present report provides a synthesis of one of those studies.

This overall research exercise on internationalisation led to a series of further reports. All of them are available on the IS Units website of the IPTS.[4]

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1 IPTS (the Institute for Prospective Technological Studies) is one of the 7 research institutes of the European Commission's Joint Research Centre.

2 PREDICT is co-financed by JRC-IPTS and the Information Society & Media Directorate General of the European Commission.

3 This report was commissioned during the period 2005-2007 by JRC-IPTS as part of the study "Towards Knowledge-based Societies. ICT for Growth and Cohesion in a Global Knowledge-based Economy: Lessons from East Asian Growth Areas". The research consortium included Frans van der Zee (TNO), Simone Kimperle and Thomas Stahlecker (Fraunhofer ISI) and several non-European PhD grantholders. It was coordinated by Professor G.N. Von Tunzelmann from SPRU, University of Sussex, UK to whom JRC-IPTS is very grateful.

4 Available on our website under the link http://is.jrc.es/pages/ISG/PREDICT.html

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Executive summary

1. Data on broadband performance show that Japan and Korea are significantly ahead of the US and Europe. Korea is by far the global front-runner in terms of broadband penetration. However, Japan is the global leader in terms of speed, price and diffusion of advanced technology (specifically fibre-to-the-home, FTTH).

2. However, this broadband performance data raises three puzzles: the US Puzzle, the Asian Puzzle and the European Puzzle:
   - *The US Puzzle*: Why is it that the US – which gave birth to the Internet and leads the world in areas such as computing, software and microprocessors – is lagging significantly behind in broadband? In 2004, a commissioner of the FCC (Federal Communications Commission, the US regulator) complained that the US was ranked eleventh in one of the key broadband league tables.
   - *The Japan/Korea Puzzle*: Why do these two Asian countries lead the world in broadband? They are not globally dominant in areas such as the Internet, computing, software, and microprocessors. Furthermore, since 1989 the Japanese economy has been in a state of recession and Korea, although it is growing rapidly, is not yet one of the richer countries.
   - *The European Puzzle*: Why is Europe lagging behind, not only the leading Asian countries, but also the US? The European Commission has created a new regulatory framework for Europe which it hopes will unleash new forces of competition. National regulatory authorities in the leading countries of the European Union claim to be broadly satisfied with the performance of their national systems. Yet Europe is a laggard in the Broadband Era.

3. This report, based on Fransman (2006), explains these three puzzles, and draws out the lessons for Europe regarding the development of broadband infrastructure, which provides the basis for the evolution and transformation of the entire global ICT sector.

4. More specifically three interrelated explanations are given: first, the role played by what are referred to as 'disruptive' competitors or new entrants; second, the importance of competition between technologies; third, the significance of the strength of regulation.

1. Introduction: the importance of broadband

A brief history of the Broadband Internet is set out in Table 1.

Table 1: Evolution of the Broadband Internet, 1995-2006

	FROM 1994: NARROWBAND INTERNET	FROM 2000: BROADBAND INTERNET
INTERNET	• Rapid adoption of narrowband Internet. • Rapid increase in demand for data-carrying capacity.	A. Phase One, 2000-04 Broadband Access • Increasing speed/bandwidth. • Falling prices. B. Phase Two: 2004 – From Broadband Access to Broadband Services • New/improved broadband CASs (content, applications, and services, e.g. voice-over-Internet, Internet TV and Video).

Source: Fransman (2006).

As Table 1 shows, rapid mass adoption of the narrowband Internet (based on dial-up services) began around 1994. Indeed, it was only in 1995 that Bill Gates, CEO of Microsoft, came to the realisation that the Internet would become the main driver of the entire ICT industry and that Microsoft would have no option but to conform to its presence (until this time his strategy was for Microsoft to develop its own network of computers). The conversion of Bill Gates to the Internet was reflected in a landmark memorandum that he circulated to Microsoft's staff, indicating his shift in thinking and re-orienting the attention and energies of his employees.

However, there were many significant disadvantages of dial-up (provided over ordinary copper telephone cables). First, with limited bandwidth, the service was slow. Second, accessing the Internet meant de-commissioning one's telephone line which presented trade-off difficulties. Third, the service was expensive. These difficulties meant that incentives were created to overcome the problems. This opened the door to broadband.

As shown in detail in *Global Broadband Battles: Why the US and Europe Lag while Asia Leads* – henceforth Fransman (2006) – there were also further incentives for telecoms operating companies to offer an enhanced Internet access service, namely broadband. They had just been through the punishing 'Telecoms Bust' from March 2000 and were still reeling from the blow. The new broadband service promised to bring in an important new source of revenue (if customers could be persuaded to pay, illustrating at the same time the importance

of the co-evolution of demand). Significantly, as shown in Table 1, broadband began its rollout from around 2000 in the advanced industrialised countries.

The widespread adoption of broadband is important for at least three reasons. First, it enhances the information and communications infrastructure by substantially increasing bandwidth and therefore speed. Second, broadband creates a new platform for innovation, making possible new and improved contents, applications and services. Internet telephony (VoIP) provides an example, a service that is currently cannibalizing the fixed telephony revenues of telecoms operators. Third, broadband is enabling the latest version of the Information Society, namely the Visual Society. Although the written word has been a key innovation in the history of mankind, our natural way of communicating is visual and aural. By video-enabling websites and communications broadband will allow us to communicate to a greater extent visually and aurally.

2. Measuring national performance in Broadband

How might broadband performance be compared across countries? If we have adequate measures we can then take the next step and try and explain any performance differences that might be observed.

Six measures are shown in Table 2.

Table 2: Some measures of national performance in Broadband

	MEASURE OF PERFORMANCE
Measure 1	Availability
Measure 2	Penetration
Measure 3	Capacity/Speed
Measure 4	Price
Measure 5	Quality of Access
Measure 6	Goodness of Fit with the Needs of Users

Source: Fransman (2006).

Measure 1 refers to the availability of broadband in different parts of the country. Availability is simply measured by the proportion of the population (or households) that have access to broadband-enabled switches. Telecoms operators (particularly the incumbents) usually have some trigger formula that stipulates the proportion (or number) of households that need to demand broadband in order to trigger the installation of broadband in the local switch. This measure is the least demanding of the performance measures. In the UK, for example, there is almost 100 percent availability. Typically, sparsely-populated rural areas are the last to receive broadband.

Penetration is the second measure. This measures the proportion of the population (or households) that actually receive broadband. Penetration has been the most widely used measure of broadband performance. For example, in the US it is this measure that features most commonly in the national debate taking place about broadband performance. As we shall see later, according to this measure of penetration the US comes eleventh globally.

However, penetration *per se* does not tell us anything about the speed that subscribers get or the price they pay. Clearly, these are also important determinants of performance. If price is relatively high and speed relatively low then the significance of broadband diminishes. It is therefore also important to take these variables into account, that is, Measures 3 and 4.

However, there is still a further measure, Measure 5 that is important. This is quality of access. Even if broadband is available, is widely penetrated/adopted, speed is high and price is low there is still a further performance characteristic that is significant. This is the quality of access, taking into account factors such as ease and continuity of access.

But even then there remains one ultimate measure of performance, Measure 6, namely the goodness of fit with the needs of users. The problem with the other measures is that they do not take into account what users want to do with their broadband connections and therefore what their broadband needs are. For instance, additional speed may just not be necessary for some applications – lower speed and even lower quality may be adequate. However, unfortunately, no-one has yet tried to create a measure for Measure 6.

2.1 Broadband penetration: a global comparison

How do countries compare in terms of their broadband performance? This question is tacked in this section by restricting attention to Measures 2, 3 and 4.

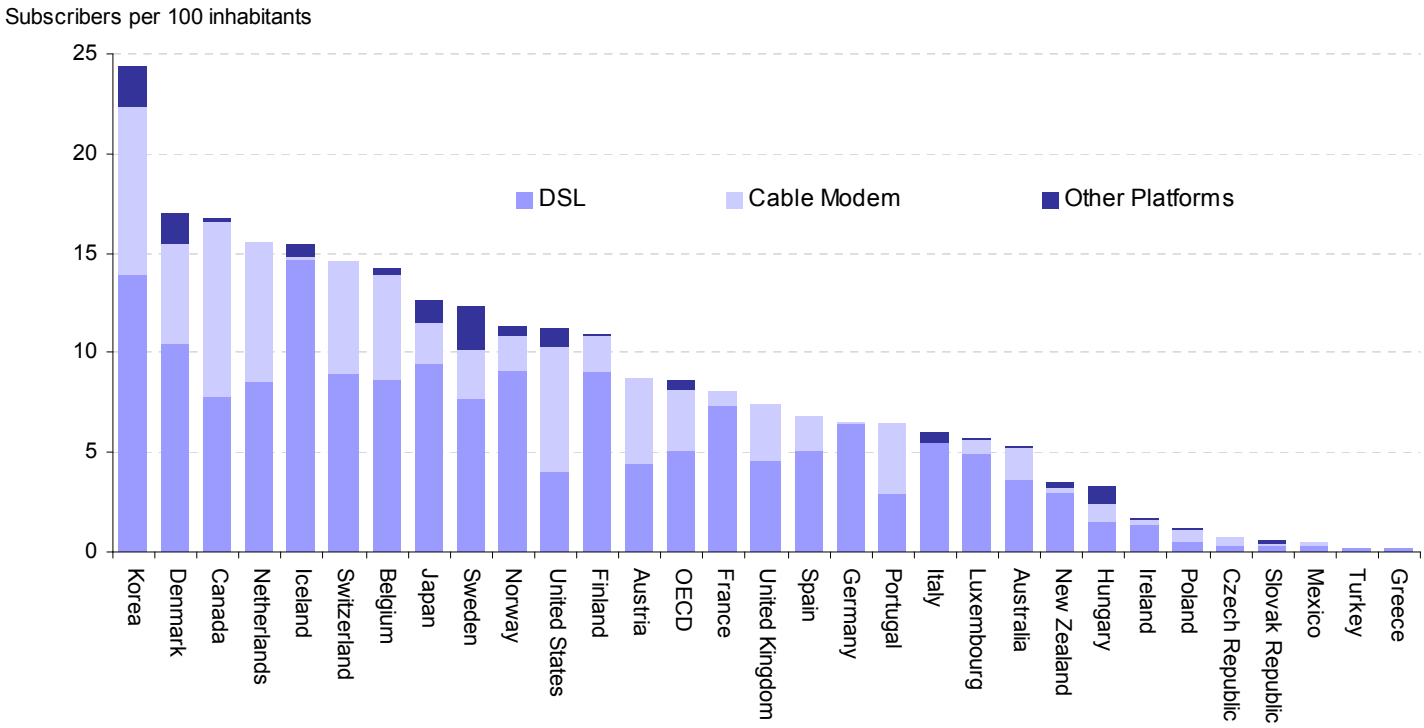
Measure 2 is examined in Figure 1, which provides data for OECD countries, published in 2005. Several features are worth noting about the figure.

The first is the outstanding penetration performance of Korea which at the time had almost 25 broadband subscribers per 100 inhabitants. Denmark, which came second, had around 17 subscribers. The detailed reasons for this outstanding (and outlying) performance are discussed in Fransman (2006), both in the introduction and in a country chapter devoted to Korea. Later in this report two of the general causes of the Korean performance are considered.

Second, it is worth examining the performance of a sample of countries included in Figure 1, namely the large countries. These include the US, Japan, Germany, France, the UK and Italy. Amongst these countries Japan was first (8^{th} in the figure), the US was second (11^{th} in the figure), France third (15^{th}), the UK fourth (16^{th}), Germany fourth (18^{th}), and Italy fifth (20^{th}).

As this discussion of performance measured by penetration clearly shows, Asia (i.e. Korea and Japan) leads, the US comes second, while Europe lags.

Figure 1: Broadband Penetration in OECD countries, 2005



Source: OECD Communications Outlook, 2005.

Third, it is worth noting the good performance of some of the smaller countries. These include Denmark (second in Figure 1), Canada (third), the Netherlands (fourth), Iceland (fifth), Switzerland (sixth), and Belgium (seventh). Part of the reason for this relatively good performance is the small size of the countries concerned and the corresponding relative density of the population, which makes the delivery of broadband easier and cheaper. But there are also country-specific reasons. For example, the Netherlands and Belgium are characterised by strong cable TV companies that compete with the incumbent and other telecoms operators to provide broadband. Figure 1 also shows the proportion of broadband provided on the two main platforms, namely DSL (provided over copper telephone cables) and cable modems (using cable TV coaxial cable).

2.2 Broadband speed: a global comparison

Performance Measure 3 is speed. Table 3 provides data for the world's top ten incumbent telecoms operators ranked according to speed.

Table 3: World's Top 10 Incumbents offering Broadband access, ranked by speed, 2003

Country	Company	Access Type	Download Speed (Mbps)	Upload Speed (Mbps)	Monthly Charge		Mbps per month
					US$	US$ (PPP)	
Japan	NTT East	FTTH	100.0	100	52.45	42.46	Unl'td
Korea	KT	DSL	13.0	N/A	42.01	67.61	Unl'td
US	Verizon	ADSL	7.1	0.8	204.95	204.95	Unl'td
Denmark	TDC Kable	Cable Modem	4.1	0.3	125.84	100.22	Unl'td
Finland	Elisa	ADSL	4.1	0.5	441.43	394.52	Unl'td
Canada	Bell Canada	ADSL	3.1	0.6	45.98	54.09	Unl'td
Belgium	Belgacom	ADSL	3.0	0.1	44.75	42.40	10000
New Zealand	Telecom NZ	ADSL	2.1	0.3	34.32	39.84	500
Sweden	Telia	ADSL	2.1	0.4	57.34	49.32	10000
Poland	Dialog	ADSL	2.1	0.5	68.11	141.59	Unl'td

Source: Fransman (2006).
Notes: Only includes the incumbent with the highest ranking capacity offer for each country.
Unl'td = unlimited.

The outstanding feature of Table 3 is the performance of the Japanese incumbent, NTT East. (NTT is divided under a holding company into five major companies: NTT East and NTT West, that both provide local services in the eastern and western part of Japan respectively; NTT Communications, that sells both long distance and international services; NTT Docomo, the company's mobile subsidiary; and NTT Data, the IT subsidiary.)

Several points should be noted about this Japanese performance. The first is the download speed which at 100 Mbps (megabits per second) is significantly higher than the second best performing company, KT from Korea with 13.0 Mbps. Second, it should be noted that Japan's upload speed is also 100 Mbps. This compares with only 0.8 Mbps for the second recorded country, namely Verizon from the US (no data being available for KT of Korea).

Third, it should be noted that Japan is the only country in the table to be offering FTTH (i.e. fibre to the home, that is the 'local loop' connection from the home to the local telecoms switch consists of optical fibre). As these data make clear, FTTH is the superior local access technology offering the highest bandwidth. FTTH provides the explanation for the significantly higher download and upload performance of Japan. (Later we will say more about the reasons for the rapid adoption in Japan of FTTH, far faster than in any other country.)

The superior performance of Japan and Korea regarding Measure 3 (speed) is confirmed by a global benchmarking study undertaken by the new UK regulator, Ofcom. In an important *Strategic Review*, incorporating a fundamental review of the state of UK telecommunications since liberalisation in 1984 and the privatisation of the incumbent BT – Ofcom (2004, pp. 5-6) reached the following conclusion regarding broadband speeds in Japan and Korea on the one hand and Europe on the other: "basic speeds available in Europe are significantly below those in Japan and Korea, and to a lesser extent, the US." This provides further evidence supporting the data given in Figure 1.

2.3 Broadband price: a global comparison

Japan and Korea also perform relatively well according to Measure 4, namely price. The relevant data are to be found in Fransman (2006) and will not be repeated here. However, it should be noted that since that data were collected there has been a significant broadband price war in Japan that has resulted in a substantial fall in prices. This war has been between the incumbent, NTT, on the one hand and several of what will be referred to as 'disruptive competitors' on the other (as discussed further below). The most prominent of these is a new entrant called Yahoo BB, a joint venture between the Japanese company, Softbank (owned by businessman Masayoshi Son) and Yahoo Japan, subsidiary of Yahoo of the US.

However, Ofcom's *Strategic Review* in its benchmarking study took account of the effects of this broadband price war. According to Ofcom's research, "Japan emerges as the cheapest country [in the world] for both residential and business users." Accordingly, Ofcom concludes, "This analysis confirms Japan's acknowledged position as a broadband price benchmark."

2.4 Conclusion regarding comparative international broadband performance

It may be concluded, accordingly, that Asia (i.e. Japan and Korea) lead, the US comes second, while Europe comes third. However, this relative performance still needs to be explained. This is necessary if policy conclusions are to be derived.

3. Explaining broadband performance

A detailed explanation (together with all the supporting evidence) of the comparative international performance noted in this paper is to be found in Fransman (2006), to which the reader is referred for further details. Here a summary of the main explanatory factors is given.

3.1 Competition between firms

3.1.1 New entrants

One of the most important drivers of broadband performance has been the activity of new entrants into the broadband market. (In some cases long-established companies have also entered and had some effect, but in general it is new entrants that have been crucial.)

However, one of most important findings in Fransman (2006) is that a further distinction amongst the new entrants needs to be drawn between what are referred to in the book as 'disruptive competitors' and non-disruptive competitors.

3.1.2 Disruptive competitors

Disruptive competition may be defined as existing when competitors to the incumbent have been so aggressive with their pricing that they do not cover their costs and end up making short run losses. Their hope is in this way to gain market share and possibly force the exit of some of their competitors. In the longer term they hope they will be able to price more profitably.

In Japan and Korea three disruptive competitors stand out as having been particularly significant. These are Yahoo BB in Japan and Hanaro and Thrunet in Korea. These three companies have been especially aggressive in their competitive struggles with the incumbents, NTT in Japan and KT in Korea. Precisely why they have been so aggressive, being prepared to pay the price in terms of short-term losses, is an intriguing question examined in more detail in Fransman (2006). Yahoo BB has only in 2005-06 entered the black while Hanaro and Thrunet both ran into severe financial difficulties necessitating significant financial restructuring and an eventual merger between the two companies.

Europe has also seen aggressive new entrants in the broadband market. Notable examples include Iliad in France (brandname, Free), Bredbandsbolaget in Sweden, and far more recently, Carphone Warehouse in the UK. However, these companies are not disruptive

competitors as defined since they have become profitable far more quickly than their Japanese and Korean counterparts.

Significantly, the US has also not seen the same disruptive competitors as in Japan and Korea. Rather, the US regulator – the FCC – has tended to rely on competition to the telecoms incumbents (now AT&T which incorporates the former SBC, and Verizon) coming from the cable TV companies. Both groups of companies are beginning to compete around offerings of so-called triple play products (i.e. phone, Internet access, and TV/video). However, this is essentially oligopolistic competition between incumbents already well placed in their core established markets – i.e. telecoms and cable TV respectively. This oligopolistic competition lacks the aggression and creative-destruction of the Japanese and Korean disruptive competitors, a fact that shows up in the performance figures analysed earlier in this paper.

3.1.3 Voice over Internet

One further indicator of the relative intensity of the broadband competitive struggle in Asia, the US and Europe comes in the diffusion of one of the first key broadband-specific new services, namely voice-over-the-Internet (or VoIP).

VoIP was first diffused rapidly in Japan. This was largely the result of the competitive strategy adopted by Yahoo BB in its competitive battle with the incumbent, NTT. There were two prongs to Yahoo BB's strategy. The first was to price disruptively in the effort to rapidly gain market share. The second was to make its offering even more attractive by offering free VoIP calls between Yahoo BB subscribers, providing an additional incentive to leave the incumbent. In addition, free broadband modems were handed out at places such as subway stations to subscribers signing up with Yahoo BB.

The result of this competitive process is shown in Table 4. The first point to emerge from the table is the relative diffusion of VoIP in Japan and the US. Japan, with a significantly smaller population than the US, had approximately five times as many VoIP users. Second is the fairly good performance of France. This is explained by the competitive activity of new entrants such as Iliad (Free) and Neuf. Third is the relatively poor performance of the UK.

Table 4: VoIP diffusion, February, 2005

Country	Number of VoIP Users
France	220,000
Germany	110,000
Japan	4,900,000
United Kingdom	50,000
United States	1,000,000

Source: Fransman (2006).

3.1.4 Importance of Local Loop Unbundling

One of the important determinants of the entry and competitive activity of new entrant competitors in their struggle with their incumbents is local loop unbundling. It is therefore necessary to say something about this.

Essentially, local loop unbundling is a regulatory concept. The idea is that incumbent telecom operators with significant market power in the local access market (i.e. the market that provides houses and businesses with access to the local telecoms network, sometimes referred to as the local loop) should be required to open their local switches to competitors so that the latter can install their own equipment and therefore directly connect with the final customer. Left to their own devices incumbents would normally have no incentive to provide this access to competitors. In many countries regulators have insisted on local loop unbundling, seeing this as a good way to increase competition in the bottleneck local access market.

An alternative to local loop unbundling is to require the incumbent to provide access to its network services on a wholesale basis. That is, the incumbent is required to provide a wholesale product (network service) to its competitors at a regulated price. Until around 2005 (under the former regulator, Oftel) this became the main form of broadband provision in the UK. From 2005/06, however, under the influence of the new regulator, Ofcom, local loop unbundling was increasingly encouraged.

It is important to understand that local loop unbundling and wholesale provision differ in one important respect. In the case of local loop unbundling the competitor to the incumbent is able to install its own equipment in the local telecoms switch and offer its own broadband services to the customer. Crucially, *this gives the competitor an incentive to compete by innovating* (i.e. to engage in Schumpeterian competition). However, in the case where the incumbent provides

a wholesale product the competitor essentially resells the same product (albeit under its own brandname, and at its own price). It does not have the ability to differentiate its product through innovation.

The timing of the introduction of local loop unbundling and the aggressiveness with which the regulator has enforced unbundling on the incumbent has been an important determinant of broadband performance, whether penetration, speed or price. (The reader should note that this is a general conclusion and excludes some important subtleties which are discussed in more detail in Fransman (2006)).

Table 5 shows the DSL (based on telephone copper cable) market share of both the incumbent and its competitors for several countries.

Table 5: DSL Market Share of Incumbent and Competitors (based on Local Loop Unbundling), 2003/4

Country (Incumbent)	Incumbent's share	Competitors' share
Germany (Deutsche Telekom)	91%	9%
Korea (KT)	82%	18%
Japan (NTT East & West)	36%	64%
UK (BT)	99%	1%
US (Baby Bells)	85%	15%

Source: Fransman (2006).

The high share held by the Japanese competitors to NTT is particularly noteworthy. Although local loop unbundling was first introduced in the US, it was most vigorously implemented by the Japanese regulator, MIC. It was this regulation that in effect subsidised the entry into the broadband market by the disruptive competitors such as Yahoo BB and other new entrants such as eAccess. The effective subsidy came from the regulation that set the access price that the competitor had to pay according to the long-run marginal cost. This in effect provided a degree of subsidised entry into the broadband market to the competitors and accounts for some of the intensity of competition in Japan.

However, the figures for Korea show that local loop unbundling is not the whole story. As we saw in Figure 1, Korea has far outpaced all other OECD countries in terms of penetration. However, while the share of competitors in Korea shown in Table 5 was 18% the figure for the US was not much less, at 15%. Yet Figure 1 shows that the US came eleventh in terms of penetration. Clearly, therefore, there is more than only local loop unbundling at work in explaining the relative performance of Korea and the US in terms of penetration.

3.2 Competition between technologies

A second explanation for comparative broadband performance is the competition between technologies (and the networks embodying these technologies). Competition between companies (already considered) is far more visible since it is companies that appear in the market place and compete. However, competition between technologies and networks is also a crucial determinant both of overall improvements in broadband performance as well as of comparative international performance.

Although less visible it is competition between technologies that is largely responsible for the improvements in performance brought about by companies. And of course, competition between companies contributes to the improvements that are brought about by competition between technologies. That is, these two forms of competition are not independent.

When technologies compete the creators of these technologies are driven (though not exclusively) by the performance characteristic of the other alternative, i.e. competing, technologies. Their goal is to make 'their' technology better. This is an important source of innovation and improvement over time.

The broadband market is especially notable for the wide range of choice between alternative technologies. The available broadband technologies include DSL (provided over conventional copper telephone lines), cable TV (provided over TV network cables), FTTH (provided over optical fibre networks), satellite, and various wireless technologies (such as wireless local loop, cellular mobile, Wi Fi, and Wi Max). A detailed discussion of these technologies, their development and advantages and disadvantages is to be found in Fransman (2006).

3.2.1 Optical fibre in Japan

A good example of the importance of competition between technologies, and the interaction with competition between companies, is the case of optical fibre (particularly FTTH, fibre-to-the-home) in Japan.

To cut a long story short, Japan leads the world by far in terms of FTTH. This accounts largely for the substantially higher broadband speeds widely available in Japan. This availability now includes all the major cities, most of the larger towns, and is now being introduced (although at a slower rate) into smaller towns in rural areas. Table 3 showed dramatically the significantly higher download and upload speeds offered by the Japanese

incumbent, NTT East, compared to its incumbent counterparts in other countries, largely as a result of the deployment of FTTH.

Competition between companies provides a large part of the explanation for the unprecedented rapid diffusion of FTTH in Japan. This competition comes from two main sources. The first is competition in the DSL market from the disruptive competitors. Partly in order to trump this competition the incumbent NTT has turned to expensive investment in FTTH that will give it significantly higher speeds. The second is competition from a new source, a source that at the moment is unique to Japan, namely competition to NTT from the subsidiaries of electricity companies. These companies have their own optical fibre networks that are used as part of the business of providing electricity services to customers. However, the electricity companies took the strategic decision to enter the FTTH market in the hope of also offering telecoms services to their customers. In order to deal with this competition NTT has also had to speed its diffusion of FTTH.

However, it must also be noted that in making the expensive investments in FTTH NTT has not only been influenced by competition. In addition, as a private company but with social commitments (required partly by law but partly also by corporate commitment) NTT has taken the decision to focus on the long run in the effort to provide Japan with the most advanced telecoms infrastructure in the world. Unlike its counterparts in both the US and Europe NTT has not been driven in making these decisions solely by short-term profit considerations.

3.3 Strength of regulation

The third and final explanation of comparative international broadband performance is the strength of regulation.

In short, the telecoms regulatory authorities – particularly in Japan but also (though to a lesser extent) Korea – have been tougher regulators than their US and European counterparts. Unfortunately, however, there is no straightforward measure of strength of regulation. This point is therefore the topic of detailed analysis in Fransman (2006), where the conclusion is that strength of regulation has also been an important determinant of comparative broadband performance, creating an environmental context and institutional framework that has helped shape the broadband outcome summarised in the performance measures.

4. The rise of China

Fransman (2006) also contains a detailed examination of China, to which a full chapter is devoted. Suffice it to say here that, although China still has some way to go before reaching the world leaders in broadband (though in mobile China is already near the frontier), the country is rapidly becoming a major global broadband player. This is illustrated in Table 6.

Table 6: Asian Broadband Subscribers, early 2004

Country	DSL subscribers (thousand)	Total broadband subscribers (thousand)
China	10,950	11,390
Japan	10,270	13,640
Korea	7,920	11,920

Source: Fransman (2006).

Table 6 shows that already by early 2004 China's absolute number of DSL broadband subscribers exceeded those in both Japan (but not by much) and Korea. In terms of total broadband subscribers China had almost caught up with Korea, although it still lagged behind Japan. However, given the rapid growth of broadband in China and the size of the Chinese broadband market it is likely that China is now ahead on these measures of both Korea and Japan (although detailed statistics are not yet available). Nevertheless, there are still significant structural weaknesses in the Chinese broadband market as shown in the China chapter in Fransman (2006).

5. Conclusions

As this report (and the book on which it is largely based) clearly shows, Asia leads while the US and Europe lag behind in broadband. This has been documented through the analysis of several measures of broadband performance.

Although the explanation for this comparative international performance is complex, three causes stand out. The first is competition between companies, particularly between the incumbent and new entrants. Here of special significance is the role played by what have been defined as disruptive competitors. The second is the interaction between competition between firms and competition between technologies (and the networks in which they are embodied). The third cause is the role played by strong regulation.

What are the lessons for Europe? It may be tempting, in answering this question, to make the following policy recommendations: increase the intensity of competition between firms and technologies/networks and strengthen regulation. However, as Fransman (2006) is at pains to emphasise, these three causes of comparative international broadband performance themselves have complex institutional determinants. Unfortunately, accordingly, deriving appropriate policy recommendations is no simple task.

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Abstract

The Information Society Unit of the IPTS (European Commission) has been investigating the Information and Communication Technologies (ICT) sector and ICT R&D in Asia for several years. This research exercise led to a series of reports, written by European and by national experts of Asian countries.

This report covers Japan and Korea and investigates the puzzling statistics related to Broadband penetration in these countries. It draws out the lessons for Europe regarding the development of Broadband infrastructure, which in turn provides the basis for the evolution and transformation of the entire global ICT sector. More specifically, the report proposes three interrelated explanations of Broadband developments in Asia: first, the role played by what are referred to as 'disruptive' competitors or new entrants; second, the importance of competition between technologies; and third, the significance of the strength of regulation.

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