

Socio-Economic and Cultural Factors Affecting Adoption of Broadband Access: A Cross-Country Analysis

The continued, ubiquitous growth of the Internet coupled with increased computer penetration in households has raised the expectations for consumers and society to reap the benefits of the 'e-society': increasing access to health care through telemedicine; diminishing the social divide through tele-education; and increasing the quality of life, and competitiveness of the economy through telework. Although these potential benefits would accrue universally to all countries, the growth of broadband access which would facilitate these applications has been varied across different countries. This paper argues that the varied rates of adoption are attributable, in part, to the aggressive government policies to deploy broadband networks and to encourage the use of these applications. Governments are motivated to deploy broadband networks to achieve competitive advantage in the global production process, as well as to alleviate some of the major societal challenges. This is especially true for the Asian economies of Singapore, South Korea and Malaysia. Independent of direct government policies, the availability of content that exploits the cultural happenstance of a country, as evident from NTT's DoCoMo experience, is another strong factor explaining the difference in broadband deployment rates. However, even if economic and social benefits exist, as in the case of telemedicine in the United States, cultural and social factors may in fact hinder the deployment of such applications and retard the growth rate of broadband access.

Introduction

Although many countries around the world have modern telecommunications networks that support broadband access to the home, broadband penetration rates vary across these countries, as shown in Table 1. Government initiatives in the various countries to establish national 'information superhighways' are key factors in explaining this difference in penetration rates, particularly in the more developed Asian economies. Governments are motivated to develop national broadband networks for several reasons. The development of such networks, either directly through use of tax dollars or indirectly by use of appropriate policies, such as spectrum allocation by fiat, would allow national governments to exploit the benefits of e-government and could encourage uptake by effectively lowering the usage

cost of applications for the consumer. Specifically, telemedicine allows governments to extend universal healthcare services to remote areas and provides, especially for developing countries, an economically viable means to increase the quality of medical services. Similarly, tele-education provides governments the means to increase the level of educational services to resource strapped inner cities and the means to extend the learning experience to the homes.

In addition, teleworking allows employees to increase their quality of life, while still being productive agents of society, and gives firms a means to decrease costs in the production process. Furthermore, from a societal viewpoint, teleworking reduces traffic congestion and helps in pollution control. Estimates reveal that business subscribers account for over 40% of all

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Table 1 Ranking of countries with highest DSL penetration

Country	DSL Lines per 100 population			
	Jan 2001	Jan 2002	Ranking 2001	Ranking 2002
South Korea	4.03	10.95	1	1
Hong Kong	3.42	5.56	2	2
Taiwan	0.70	4.83	7	3
Canada	1.43	3.73	3	4
Denmark	0.94	2.85	6	5
Belgium	0.42	2.76	9	6
Germany	0.23	2.23	12	7
Sweden	0.45	2.18	8	8
Finland	0.16	1.66	13	9
US	0.89	1.59	5	10

Table 2⁶ Gross product of US majority-owned non-bank foreign affiliates as percentage of gross domestic product of selected home countries

	1989	1994	1999
Ireland	12.4	12.1	16.8
Singapore	7.8	8.1	10.7
Canada	9.5	8.8	10.0
Honduras	5.6	8.3	7.4
Nigeria	5.7	4.2	8.1
United Kingdom	6.2	6.1	7.0
Malaysia	4.6	5.1	6.2
Hong Kong	4.6	3.7	4.9
Thailand	2.5	1.8	2.6
South Korea	0.3	0.4	0.8

broadband subscriptions (cable, fixed wireless, satellite, and xDSL). With an estimated 32 million daytime telecommuters in the US, there is a clear need for low-cost access. As remote workers in large firms demand more high-speed and IT services and equipment, investments in the remote workforce can be expected to grow in the coming years¹.

As shown in Table 1, the US lags in xDSL penetration. This can be attributed to several factors, including the lack of enforcement of the Telecommunications Act of 1996 which left the incumbent carriers in control of the DSL market together with little governmental promotion of broadband development.

Broadband Driving Foreign Direct Investment

A key economic consideration for some governments to develop a broadband network is to create competitive advantage in attracting direct investments by multinational corporations (MNCs). Foreign direct investments (FDIs) increase domestic capital formation, augment host country stocks of technology and managerial expertise, improve access to export market, and provide comparatively stable source of external financing². Furthermore, FDI strengthens a host country's ability to reach international markets through its international links. In general, the investment flows to East Asian economies have been directed at creating export-oriented industries³. The rapid growth of many of the East Asian economies is accredited to a strategy of building industrial capabilities through foreign direct investment, achieved principally by creating favourable conditions for MNCs to locate their activities in their respective economies⁴. As expected, many of the East Asian economies are countries

with some of the highest broadband penetration rates, as partly reflected in Table 1. Table 2 illustrates the importance of multinational corporations and foreign direct investment in the gross domestic production of select countries. In Singapore, for example, the total production of US MNC affiliates constituted some 10% of Singapore's gross domestic product. Altogether, there are some 6000 MNCs located in Singapore⁵.

Not surprising, the Singapore government has been most aggressive in promoting the deploying of new technologies and broadband access, as manifested in several initiatives. Relatively high labour costs in Singapore, as shown in Table 3, coupled with a high employee turnover rates, particularly in the IT sector, manpower shortage and high overall cost of doing business in Singapore are motivating the government to look to e-commerce solutions, as some have observed, to eventually encourage firms to adopt teleworking⁷.

An opening public initiative was TradeNet, which facilitates trade documentation online. TradeNet processes 99% of all trade permit declarations, and is used by over 2400 companies. Thus far, TradeNet has reduced the processing time from several days to five minutes. TradeNet Plus, a more complete and efficient version that incorporates other online features, such as payment and insurance, is expected to further reduce processing time to between

one and three minutes. When fully implemented, TradenetPlus is expected to generate annual savings of some \$2.8 billion⁹.

Next, the Singapore government's Singapore ONE (One Network for Everyone) programme, is a high-speed optical fibre network that manifests the government's IT2000 master-plan, a blueprint to deploy IT in almost every government department designed to transform the state into an 'intelligent island'¹⁰. The IT2000 master-plan calls for all of Singapore's over 800 000 households to be connected to a hybrid-fibre coaxial network, irrespective of whether they intend to subscribe to the various services¹¹. The Singapore ONE initiative strives to develop a nationwide broadband network to link businesses, homes and schools, to deliver interactive, multimedia applications and services¹². It is estimated that by 2005, some 2–2.5 million users will connect to this broadband network¹³. In this respect, the Singapore government's eCitizen Center is an integrated service delivery designed to ensure that the public sector operated, and was seen to operate, as a single entity. This particular project is aimed at bringing together useful services and delivering them to Singaporeans in convenient and easily accessible packages. The Singapore government hopes that eCitizen will enhance the ability of the public to be increasingly familiar and comfortable with IT, which has become a

Table 3 Hourly earnings in manufacturing in US dollars for selected countries⁸

	1996	1997	1998	1999	2000
Hong Kong	5.14	5.42	5.47	5.44	5.53
Singapore	8.32	8.24	7.77	7.13	7.42
Korea	8.22	7.86	5.67	7.05	8.13
Taiwan	5.95	5.91	5.27	5.62	5.98

critical component in the knowledge economy¹⁴.

Another government initiative seeks to raise the percentage of small and medium-sized enterprises (SMEs) conducting e-commerce to 25% within three years time. According to a survey conducted late in 1999 by the Singapore IT Federation, while 91% of the top 1000 companies already had Internet access, only 4% of the 92 000 SMEs were conducting e-commerce¹⁵. Sixty-six per cent of SMEs with sales below \$1 million cited lack of in-house IT skills and infrastructure, inadequate knowledge of e-commerce, and low budgets as barriers to implementing e-commerce¹⁶. As such, the Economic Development Board (EDB) will assist businesses in their e-commerce strategy by supporting up to 50% of their external consultants' costs in formulating a business plan or business collaboration venture, conducting feasibility studies, or providing assistance in implementation, up to a maximum limit of S\$250 000^{17,18}. The government also unveiled a three-year, \$11.7 million plan to prod the city's growing logistics industry into doing more with the Internet. Singapore's transport and logistics industry contributed more than 7% to gross domestic product last year¹⁹.

As shown in Figure 1, CTM Telecom Outlook's survey of telecommunications experts found that government subsidies to SMEs is an effective way to increase broadband take-up for this group²⁰.

The Singapore government's GeBIZ initiative is an attempt to create a one-stop, round-the-clock centre for the government's business dealings. The first phase was launched in April 2000²¹. GeBIZ enables the financial systems of ministries and the procurement applications to work together. Trading partners can find invitations to tender and purchase orders on the site. Suppliers can also submit invoices, check payment status, post their catalogues and bid for contracts. Currently, purchases are capped at S\$30 000 (US\$17 341), but the Ministry of Finance estimates that once new payment and security systems are introduced, 80% of all government procurement will transfer to GeBIZ. As with other online B2B trading networks, the benefits come in

Table 4²⁶ Malaysia: Total proposed capital investment in approved manufacturing products

	1996	1997	1998	1999	2000
Total (millions of ringgits)	34 258	25 851	26 338	17 021	33 609
By Ownership					
Foreign	12 956	4 220	7 390	7 825	14 452
Joint	15 122	17 482	12 236	7 906	15 819
Malaysian	6 180	4 119	5 762	1 290	3 308
By Industry					
Electrical and Electrical Products	13 062	6 223	2 412	7 082	12 182
Natural Gas	2 137	0	110	0	7 225

the form of more competitive bidding, easy access to suppliers round the world, time saved by online processing of orders, lower stocks and automated collection of high-quality data²².

Taiwan launches National Information Infrastructure Plan

Similarly, the Taiwanese government has launched the National Information Infrastructure (NII) Plan with a budget of US\$10 billion through 2005, designed to establish Taiwan as an Asia-Pacific Internet hub. The Taiwanese NII will be a broadband information superhighway consisting of coaxial cable, optical fibre and satellites, which will provide interactive voice, data, and video service island-wide, and will be linked with international networks²³. An estimated 60% of Taiwan households, approximately 3.3 million, subscribe to cable television.

Several government initiatives under the Taiwanese NII plan are propelling the growth of the Internet. One such initiative is the Basic Information Education Plan (BIEP) with a budget of US\$170 million. The BIEP includes using TANet (Taiwan Academic Network) to incorporate computer courses into the regular curricula for both primary and junior high schools, and for teacher training. Other projects that enhance the growth of Internet application software in Taiwan include the Social Education Information Networks (Lifetime Learning Services) budgeted at US\$11.1 million, and Long Distance Teaching Service Program with a US\$22.2 million budget. These are all four-year projects, which were instituted in July 1997. In addition, the Citizen's Convenience Service Program, the Electrification and Linkage of Government Organizations, Internet Exhibition of the National Palace Museum's Artifacts, Electronic Library Services, Three Million Internet Users in Three Years (1997-1999), and Electronic Commerce for Diverse Industries are also strategic projects for the promotion of Internet applications²⁴.

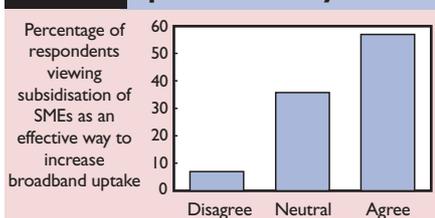
Malaysia seeks foreign direct investment through improving infrastructure

In much the same way, Malaysia is striving to become a fully developed economy by early next century through its Vision 2020 programme, designed to shift focus to high value-added products with more automated operations. Malaysia sees itself well suited for high-tech and knowledge-driven industries, believing that it will eventually lose its competitive advantage in labour-intensive manufacturing to highly populated countries such as China and India that have even lower labour rates. Malaysia aspires to be a global leader in the IT sector by producing leading-edge technology products to be developed and used within the country and exported. As a result, various government policies and initiatives focus on IT-related industries²⁵. The role of MNCs and their foreign direct investment in Malaysia's Industrial Plan is evident from Table 4.

Malaysia's most prominent IT project is the Multimedia Super Corridor (MSC). Unveiled by the government in August 1996, the MSC encompasses a 15 by 40 kilometre area, stretching from the Kuala Lumpur City Centre to the new Kuala Lumpur International Airport (KLIA). This region will be transformed into a multimedia research and manufacturing zone. It will be the future home of Putrajaya, the paperless Malaysian federal government, and Cyberjaya, a new information-age industrial and residential city. Projected to run well over US\$40 billion, the MSC will include telesuburbs, technology parks, and a multimedia university²⁷. The MSC will be equipped with a state-of-the art telecommunications and network infrastructure capable of supporting interactive applications and serviced by high-speed connections to Japan, the United States, Europe and the ASEAN region.

When entirely completed, the MSC asynchronous transfer mode (ATM) based fibre-optic network will support an automated information network (AIN) telephones and enhanced services, cable

Figure 1 Increasing broadband uptake—survey results



television, video-on-demand, data communications, MSC applications and teleport services. Telecom Malaysia is also considering using ADSL technology to connect to homes and offices. The fastest growing service at present is dedicated ISDN networks²⁸. The infrastructure will also be linked to Telekom Malaysia's corporate information superhighway (COINS) network. COINS is an open multimedia network with extremely high-speed capacity²⁹.

The Malaysian government has designated seven 'Flagship Applications' it seeks to develop in partnership with private firms that have gained MSC status. These applications are in the following areas: electronic government, smart schools, telemedicine, multi-purpose smart card development, borderless marketing, a research and development cluster for developing software and next-generation multimedia technologies, as well as a multimedia-based worldwide manufacturing web that will serve as a support hub for firms in high-cost countries to access lower-cost facilities throughout Malaysia and the region³⁰.

The role of advanced telecommunications infrastructure in Hong Kong

Hong Kong's Special Administrative Region (SAR) has one of the world's most sophisticated and advanced telecommunications networks which is crucial for becoming a business, financial and industrial centre. Hong Kong SAR's banking sector is the second largest in Asia, after Japan, and in terms of total bank assets to GDP it is only matched by Singapore, as shown in Table 5³¹. It is the largest teleport in Asia. Large investment in communications technology has made the telecommunications market in Hong Kong highly efficient and cost-effective for the manufacturing industry. An advanced network, together with its wide range of professional and high value-added manufacturing support services, ample supply of skilled and low-cost workers from China and other Asian-Pacific countries, and

coupled with cross-border production competence of Hong Kong companies, has positioned Hong Kong as a control centre in global production and sourcing³².

Besides using the Internet for web browsing, there is an increasing trend by Hong Kong corporations to use the Internet as the backbone to develop intranets for mission critical applications, including dynamic access to databases, and functional applications such as purchasing, trading, and inventory control. The rapid growth of the Internet and intranets is generating rapid expansion in LANs³⁴. Hong Kong has a high level of LAN penetration—approximately 70% of all corporations.

Hong Kong's trade and financial community is extremely 'IT oriented'. The Hong Kong Trade Development Council (HKTDC) promotes Hong Kong's goods and services by serving as an information broker and matchmaker among traders, exporters, manufacturers, buyers, and service providers. With the advent of the World Wide Web, the HKTDC introduced a host of electronic advertising and publishing activities to take advantage of the Web's instantaneous, low-cost information distribution to a wide online audience.

Tradelink Electronic Document Services Ltd. is a private company set up in 1988 by some of Hong Kong's leading private sector organisations with the aim of researching, developing and promoting the use of electronic trading at a community level. The Tradelink project was designed to provide a community electronic trading service for the benefit of Hong Kong's 65 000 import and export trading firms. The Hong Kong Government became a shareholder in 1992 and currently holds a 48% stake in TradeLink. Government involvement has encouraged the take-off of electronic trading in Hong Kong through the provision of incentives in the form of preferential charges for Trading Quota License applications and Trade Declarations submitted electronically. As a result, even with Tradelink's handling charge added, it costs

no more to use the electronic link than the paper service³⁵.

Korea's initiative to develop a broadband infrastructure

Korea's Information Infrastructure Program will comprise a national and a public network. The national network will be the backbone linking government agencies, local administrations and research and educational institutes. The public network will connect residences and businesses. Phase I of the network, which included the installation of fibre-optic cable linking 80 major cities and towns across the country was completed at the end of 1997. Phase 2, scheduled to be completed by 2002, will provide high-speed video services, such as distance learning and telemedicine. Phase 3 is scheduled to be completed by 2010 and will facilitate high-speed multimedia services. The public information superhighway was designed to bring fibre to the office by the end of Phase 1, fibre to the curb by the end of Phase 2, and fibre to the home in Phase 3.

By the end of 2002, Korea plans to have fibre-optic drops installed at all offices and business establishments in major cities and commercial buildings in 78 small cities. In 2010 when the final project phase is completed, the goal is to create an environment where 90% of an estimated 33 million PC online service users will have integrated communications services. Thus, 19 million users will be covered by fibre-optic cable lines, 5 millions by digitised coaxial lines and 1.1 million by wireless local loop (WLL) lines. The remaining 10% of the PC online subscribers may access such services through modems on existing telephone lines³⁶. The total cost of the infrastructure is estimated at some \$50 billion. The Korean government has earmarked \$1 billion to build the national network, while \$50 billion will come from the Telecommunications Carrier Fund to build the public network. The government is also developing several multimedia pilot projects, including distance learning, telemedicine and distance agricultural guidance³⁷.

Cyber Korea 21 is a more recent government initiative to principally boost information technology at the school level, as well as to increase industrial competitiveness particularly in the steel and shipbuilding sectors through the use of e-commerce³⁸. The importance of foreign direct investment in the Korean economy can be seen from Table 6. In 1998, FDI was equal to some 14.8% of total gross domestic investment in the Korean economy. With policy reforms to allow increased foreign participation in the Korean economy, including the purchase of troubled corporations, the value of FDI between 1997

Table 5 Banking system assets at end of 2000³³

	Total Assets		External Assets	
	(in US\$ billions)	(percentage of GDP)	(in US\$ billions)	(percentage of GDP)
Hong Kong SAR	734	451	451	277
Singapore	417	450	346	195
United States	8538	87	863	12
United Kingdom	3981	283	1803	127
Japan	6789	152	740	17
Germany	6031	153	542	16

Table 6⁴¹ Korea: approved FDI by source country

	(millions of US dollars)				
	1994	1995	1996	1997	1998
Japan	428	418	255	266	504
United States	311	645	876	3190	2975
Europe	406	475	1058	2409	2968
Total	1316	1914	3203	6971	8852

and 2000 quadrupled and share increased from 2% of business financing to 13%.

Due in part to the government's information policy, the online education market is expected to sustain an annual growth rate of some 36% and would amount to some 2.5 trillion won by 2003³⁹. Similarly, it is estimated that more than half of Korea's 15 million households currently have broadband Internet connection⁴⁰.

Ireland's strategy to attract foreign investment: investment in telecommunications infrastructure

The Irish government also remains strongly committed to a policy of Ireland becoming a major hub for e-commerce in Europe. To achieve this goal, it has developed a five-prong comprehensive strategy namely: (i) developing world-class international telecommunications community; (ii) enacting proactive e-commerce legislation; (iii) developing an e-commerce campus in a 100-acre National Digital Park; (iv) supporting SMEs to develop e-commerce strategies; and (v) instituting an 'Information Age' programme for the education sector. The Irish government has been committing an average of 37% of its annual expenditure on productive infrastructure between 1994 and 1999⁴². A key element of the Irish government's strategy has been to expand high-speed Internet connectivity, while sharply lowering costs, including underwriting an \$80 million project to lay a 40 Gbit/s pipeline to connect Ireland with its international network. The project was designed to ensure the MNCs that Ireland had enough bandwidth to support the operations of their e-commerce activities⁴³.

Significance of Social and Cultural Factors for Broadband Adoption

Although economic factors can be important drivers of broadband penetration, growth also requires a transformation of societal structures and institutions as well as an existing receptiveness to using the services and applications that can be provided through broadband.

Specifically, a variety of social and cultural factors explains the growth of the Internet in the United States, including the

fact that the US is a highly mobile society with little attachment to place. Also, population density is relatively low relative to much of the developed world, and suburban life continues to increase with single-family homes the standard. With high mobility across great distances the rule, the Internet offers a benefit in terms of maintaining communication links between families and friends, and colleagues. In addition, the society has a high degree of receptiveness to technological innovation.

Furthermore, the decentralised governance of the Internet and the market structure in the US led to a reduction in the cost of web connections, flat-rate access schemes, and the emergence of high-speed bandwidth systems via telephone lines, cable systems as well as satellites. As a result, there has been a fast spread of Internet connections and use. However, take-up rates for broadband to the home have not met expectations.

As such, even when broadband connections are available, consumer demand remains an issue: residential consumers may not find broadband useful to their lives, or there may be insufficient services and content to justify subscribing to broadband when it is available. Unlike the Asian economies described above, the US government has not to date established any comprehensive national policy to drive broadband development and adoption rates.

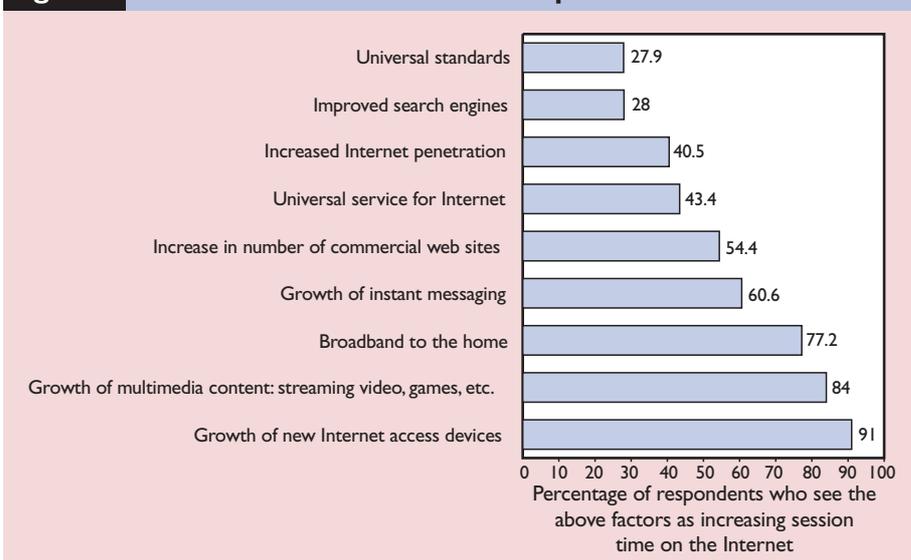
Another major difference between the information superhighway programmes in the Asian countries and the rest of the world is the concomitant government initiatives (in collaboration with the private sector) to develop content, particularly multimedia and IT applications. In Malaysia, for example, the government has established a gamut of incentives to encourage the development of seven 'Flagship Applications', including telemedicine, smart schools and electronic government, for its 'Multimedia Super Corridor'. In much the same vein and for similar objectives, Taiwan has established the 'Internet Applications/Electronic Commerce Program'. Similarly in Singapore, the government has inaugurated a 'Pioneers' Club' to cultivate innovative applications and content providers for its Singapore One Network. Club members are rewarded with benefits such as preferential rates for broadband usage as well as reimbursements of up to 70% of the cost for being new applications or content online.

The results of the Telecom Outlook Report survey of experts, shown in Figure 2, indicates that the development of multimedia content which requires a high-speed connection will encourage people to spend more time on the Internet⁴⁴. In addition, broadband access is seen by a vast majority of experts as a basic condition that must be met in order to increase the amount of time that people spend on the Internet in the US.

Social factors behind the success of the Japanese wireless Internet

The unexpected success of i-mode, the Internet-enabled phone service from NTT DoCoMo in Japan⁴⁵, illustrates the pivotal role that culture and social traits play in explaining the different adoption rates for new technologies. In this case, social and

Figure 2 Factors that will increase time spent on the Internet



cultural factors as well as geographical and historical circumstances in large part account for the unprecedented growth of i-mode: since its launch in February 1999, i-mode has attracted on average some 500 000 new users monthly and currently has some 40 million users⁴⁶. While the European market has not yet met hopes for wireless Internet access, Japan remains the only market that has exceeded expectations. However, it is still debatable whether the success of i-mode is transferable to other markets with different cultural, geographic, and societal influences.

A major factor behind i-mode's initial success was its complementarity with the lifestyle of young urban Japanese consumers and the focus on entertainment-related content. i-mode is hugely popular in densely populated cities like Tokyo where waiting in lines, frequent traffic jams and general delays are commonplace. Some 55% of i-mode accesses in the first few months of 2000 were to entertainment related areas, with the most popular categories including downloads of ring tones, characters and other pictures, horoscopes, games and information about music⁴⁷. Overall, the trade-off between 'reach' which explains accessibility and ubiquity of coverage, and 'richness' which is the depth of content as well as interactivity, customisation, and bandwidth, was appropriate for the cultural background and lifestyle of the Japanese consumer⁴⁸.

In addition, the relative rarity of home computers in Japan is another significant factor behind the i-mode's success. Despite Japan's image as techno-friendly, in fact, the number of households with Internet access only passed one in five this year—one of the lowest rates among industrialised countries. In addition, expensive Internet connections and phone calls via wireline connections have led to a high acceptance of the wireless Internet compared to the US or Western Europe. As a result, wired penetration of the Internet has remained extremely low in Japan relative to other markets where wireless access is viewed as an alternative rather than primary means of Internet access⁴⁹. Thus, i-mode provides a cheap alternative to accessing the Internet for Japanese consumers, providing information and services calibrated to the specific needs and culture of the society⁵⁰.

Applications expected to drive broadband growth: telemedicine

The United States presents a distinct contrast to Japan in the adoption of new technologies. Specifically, in the United States, the value-proposition for telemedicine is attractive. Health care in the United States has been experiencing

substantial and ever-increasing cost pressures which could be addressed in part by telemedicine. Despite the economic benefits and the fact that telemedicine technology has existed since the 1920s, usage has not been widespread due to structural and social constraints. These barriers include low compatibility with existing medical practices, complexity of telemedicine equipment and interfaces⁵¹, the absence of reimbursement by third-party agencies, and incompatibility of state laws regarding telemedicine and licensure issues⁵². However, a driving force behind the implementation of many telemedicine projects is the presence of a highly placed, motivated leader within the medical community. Interviews with telemedicine directors have revealed that project leaders tended to be charismatic entrepreneurs, enthusiastic, energetic, self-sacrificing, impatient for change and true believers in their cause. Currently, in light of the structural and organisational barriers that are constraining the growth of telemedicine, the presence of a strong leader is crucial to progress in this arena.

Overall, the social system surrounding the adoption of telemedicine is very structured and complex. In addition, the lack of clear support from key institutions, such as the American Medical Association and most medical colleges and medical schools, save the American College of Radiology, presents another impediment. This ambivalence is linked to four major social impediments to the use of telemedicine.

First, the cost of implementing a telemedicine infrastructure is a large obstacle. Currently, a large majority of telemedicine initiatives are sponsored by organisations where reimbursement is not crucial, like research centres, the Armed Forces or state-owned hospitals, and these initiatives are frequently financed by demonstration grants. Only a small number of for-profit medical centres are involved in telemedicine and many of these, like the Mayo Clinic, are employing closed telemedicine systems⁵³. Furthermore, medical organisations are reluctant to purchase equipment because of the risk that it will be quickly outdated^{54,55}.

Secondly, under the present individual state licensure system the potential of telemedicine is limited to the somewhat arbitrary borders of a state, thus limiting geographic reach. Physicians are required to have medical licences in each state in which they practice⁵⁶. Thirdly, 'there is significant uncertainty regarding whether malpractice insurance policies cover services provided by telemedicine'⁵⁷. The legal problems associated with telemedicine malpractice

liability are especially intricate⁵⁸ when services cross state borders⁵⁹.

Finally, like other communications technologies, there is a concern regarding the security of personal medical information stored in telemedicine systems. Sanders notes the possible use of encrypting algorithms and legal precedent (yet to be defined) determining 'reasonable and customary' efforts in protecting individual's information⁶⁰.

Thus, it is clear that significant non-technological barriers exist to the widespread adoption of telemedicine in the United States, including regulatory, cultural and cost issues.

Conclusions

In sum, although it is difficult to completely account for the differences in the deployment and adoption rates of broadband access throughout the world, a few provisional conclusions can be made. First, due in large part to the high costs for deployment of advanced networks, thus far, the most extensive examples of implementation including Hong Kong and Singapore have occurred due to strong government involvement. These governments are motivated to implement high-speed networks largely for clear economic reasons: to encourage foreign direct investment. In the US by contrast where the role of FDI in the domestic economy is relatively less important, coordinated efforts from the government are lacking. Next, on the consumer side, significant use of high-speed networks can be expected to occur when services and applications are available that improve the quality and ease of life.

Current studies show that although individuals are becoming more reliant on the Internet for major areas of their lives, including major purchases like homes and cars, health, maintenance of interpersonal relationships, their activities can still be conducted via a narrowband connection⁶¹. While email and information gathering are still the primary reasons to use the Internet, there are applications that are important to everyday life and require broadband access: tele-education, teleworking, and telemedicine are the most likely applications that will spur broadband growth. In mature Internet markets including the US, Sweden, and Denmark, exchanging information and sending emails are primary activities⁶².

Finally, the importance of considering social and cultural factors is paramount to understanding the different ways that broadband will develop and grow throughout the world. Although applications, content and devices must be appropriate to cultural context, a transformation of social structures and organisations is crucial to support greater ubiquity of broadband in daily-life activities.

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