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Conference Paper

Broadband Adoption: Translating the Digital Divide Literature into Effective Government Policies and Actions

27th European Regional Conference of the International Telecommunications Society (ITS): "The Evolution of the North-South Telecommunications Divide: The Role for Europe", Cambridge, United Kingdom, 7th-9th September, 2016

Provided in Cooperation with:

International Telecommunications Society (ITS)

Suggested Citation: Levin, Stanford L.; Schmidt, Stephen; Scott, Graham (2016) : Broadband Adoption: Translating the Digital Divide Literature into Effective Government Policies and Actions, 27th European Regional Conference of the International Telecommunications Society (ITS): "The Evolution of the North-South Telecommunications Divide: The Role for Europe", Cambridge, United Kingdom, 7th-9th September, 2016, International Telecommunications Society (ITS), Calgary

This Version is available at:

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**Broadband Adoption: Translating the Digital Divide Literature into Effective
Government Policies and Actions**

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Presented at the 27th European Regional Conference of the International
Telecommunications Society (ITS), Cambridge, England, September 7-9, 2016.

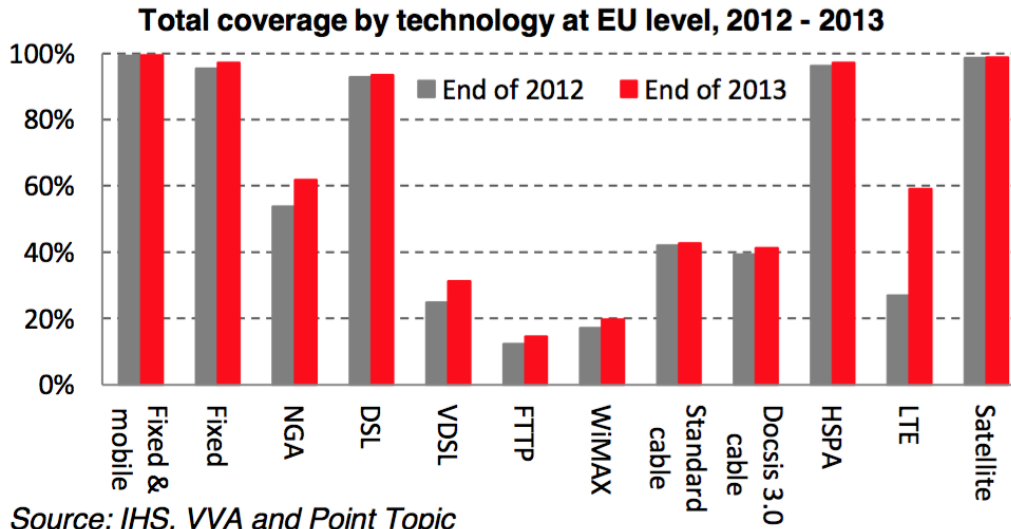
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I. Introduction

North America, many countries in Europe, and some countries in East Asia with advanced telecommunications networks have benefited from substantial investment aimed at increasing broadband availability for residences and businesses. In some countries, such as the U. S. and Canada, this investment has taken place as a result of market forces, with little attention from government, while in other countries government involvement has been relatively greater, whether in the form of directed private investment or direct public ownership. As a result of these differing approaches, broadband is widely available in many countries. For example, in 2014 in Canada (CRTC 2015, p. 23 and p. 209), 99% of households have access to broadband, 96% of households have service with at least a 5 Mbps download speed, 81% have access at 30 Mbps or faster, and 71% have access at 100 Mbps. In the U.S., 96 percent of U.S. households have access to speeds equal to or greater than 10 Mbps, and 99 percent of Americans can now access service of at least 3 Mbps. Over 50 percent have access to service at 100 Mbps or more (Ehrlich, 2014).

In Europe, the situation is similar, with nearly 100% broadband availability, as evidenced in Figure 1 (European Commission, 2014).

Figure 1: European Broadband Coverage



While a lot of press attention is focused on companies that may be able to provide 100 Mbps download speeds, or even 1 Gbps, such very high speeds are not actually required at this time and for the next few years, even for the most demanding services such as watching high-definition video. This is evidenced by the fact that residential customers often do not subscribe to the fastest broadband speed available. Specialized users, such as medical facilities, can usually obtain extra-fast broadband if it is required.

While governments around the world have been taking action, via national broadband plans and others means (policies of platform competition, public ownership of broadband networks, etc), to expand broadband availability, the issue of adoption has enjoyed less prominence than governmental programs aimed at increasing broadband availability. However, the facts show a material gap between broadband availability and broadband adoption even in regions like North America that have been quite successful at making broadband networks available. In Canada, for example, while 99% of households have access to broadband, only 82% actually subscribe (CRTC 2015, p. 187). A similar material gap between availability and adoption is evident in the U.S.

This paper accordingly asks two principal questions:

- (1) What are the reasons why the adoption of broadband lags behind availability in countries with advanced communications networks?
- (2) What policies or actions are necessary to increase adoption?

Broadband is undeniably important in increasing economic efficiency, as well as providing communication opportunities and entertainment for individuals. In countries with advanced telecommunications networks, broadband is generally available to all or nearly all households and businesses. Indeed, if there are any areas without service, they are likely to be small isolated rural or remote areas. For many or most subscribers, broadband is available at speeds that exceed those required by households and businesses. What this means is that encouraging the adoption of broadband should be the key policy objective in order to close the gap between broadband availability and adoption and to bring the benefits of broadband to economies and individuals. Efforts focusing on broadband availability are likely to be costly and to have a small payoff compared to efforts focusing on broadband adoption. To this end, it is imperative to understand the impediments to broadband use so that effective policies can be designed and implemented.

II. Literature Review

A digital divide literature has developed in the last decade, considering the household and individual characteristics associated with Internet and broadband adoption (Carare *et al.*, 2015, 21). Several findings emerge from this literature. *First*, broadband adoption is positively associated with higher income and higher educational attainment. *Second*, broadband adoption tends to be lower for older individuals. *Third*, broadband adoption rates tend to be lower in rural areas. *Fourth*, at least in the United States, race is a significant factor explaining broadband adoption. Broadband adoption rates tend to be lower for households that are African-American or Hispanic (Carare *et al.*, 2015, 21). *Fifth*, price is not a significant determinant of broadband adoption. *Sixth*, the unbundling of networks is associated with reduced adoption because of the negative effect of

unbundling on investment (Crandall *et al.*, 2013). Platform competition may also lead to higher rates of adoption resulting from the increased competition in the market.

It is apparent that there is not one dominant factor that causes lower rates of broadband adoption as compared to broadband availability. Researchers have found that low broadband adoption is explained by a variety of factors, the most important of which are age, education, and income.

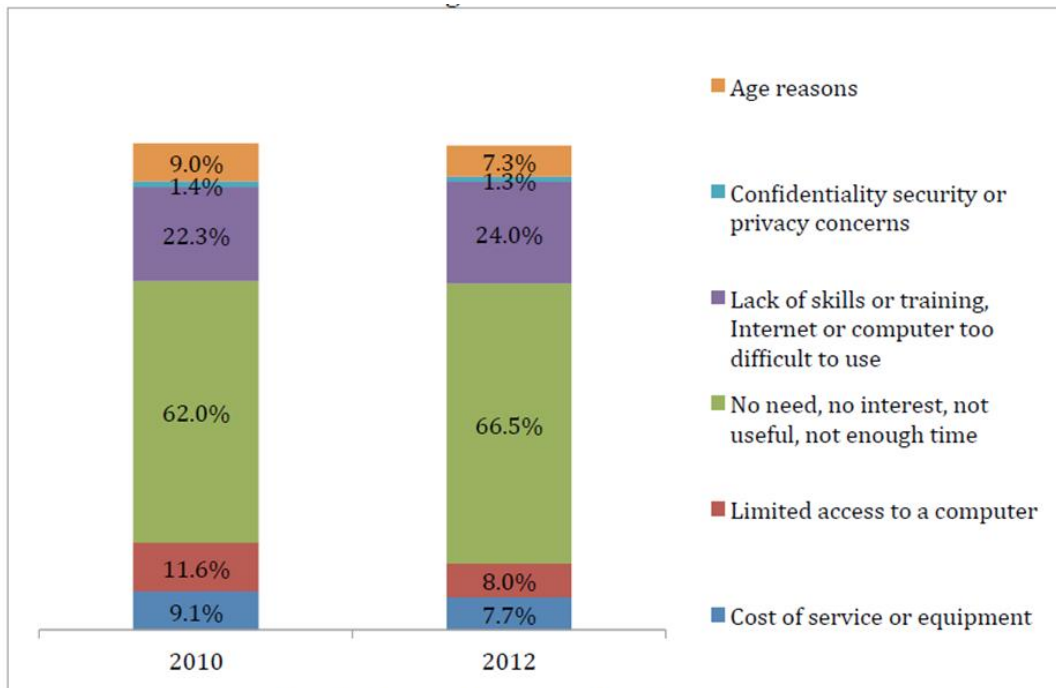
Age, education, and income are the greatest contributors to the non-adoption of broadband services, at least in more developed countries where broadband deployment has reached an advanced stage. Landry and Lacroix (2014) identify a number of trends in Canada, for example, that have contributed to the lagging adoption of Internet services, as seen in Figure 2. Using regression analysis to examine a set of socio-economic variables, the authors find that age, education and income are key predictors of an individual's Internet use (Landry and Lacroix, 2014, p. 10). Citing statistics from both the 2010 and 2012 Canada Internet Use Surveys, the authors show that non-Internet users most often cite a lack of interest and a lack of skills or training as key reasons why they do not access the Internet (Landry and Lacroix, 2014, p. 13). The cost of service or equipment was cited as a reason by only 9.1% of non-Internet users in 2010 and only 7.7% of non-Internet users in 2012 (Landry and Lacroix, 2014, p. 13). The authors, citing Chaudhuri *et al.*, (2005), suggest that consumer decisions to purchase an Internet subscription are “only modestly sensitive to price, thus rendering access subsidies only partially effective tools in bridging the digital divide” (Landry and Lacroix, 2014, p. 14). In another study, Carare *et al.*, (2015) surveyed households that do not subscribe to broadband. Two-thirds of those households indicated that they would not consider subscribing to broadband at any price (Levin, *et al.*, 2015).

Additionally, according to Pew (2015-2), 70% of Americans who have never adopted the Internet have no interest in subscribing at any price. The OECD (2015, p.137) shows that other factors, namely age, education, and income levels, are the primary causes for Internet non-adoption. Whalley and Sadowski (2016, p.1) also indicate “that broadband adoption is strongly correlated with age, income and education.” They show how age

and socio-economic class are the most influential factors that affect broadband adoption in the UK, similar to findings on income, education and employment status in the U. S. The Pew Research Center (2014) found that seniors that are younger (ages 65-69), have a higher-income (\$75,000 or more), and are more highly educated (college degree) have broadband adoption rates equal to those of the general public. Therefore, a higher income and higher education may moderate age as a determinant of broadband adoption.

The persistence of lagging digital skills among non-Internet adopters has been an ongoing issue for ISPs and regulators. Atkinson (2009) identified skill deficits as contributing to non-adoption. Notably, Hauge and Prieger (2010) challenge the notion that supply-side regulatory responses alone can stimulate broadband adoption. They underscore the importance of focusing on demand-side policies to encourage adoption, including building knowledge, such as digital skills, about new technologies among potential adopters. Similarly, Atkinson (2009) shows how different rates of Internet adoption in Japan versus South Korea, two countries with wide-scale broadband availability, can be explained by well-funded programs targeting usability and affordability, such as digital literacy programs that target Internet population groups that lag behind in terms of Internet adoption (Atkinson, 2009, p. 2-3). Belloc *et al.*, (2011) make the same point that in advanced countries, supply-side policies are what are required to be effective in increasing broadband adoption. The biggest gains to advanced economies and citizens in these countries are likely to be from increasing adoption and not from marginal increases in already widely-available broadband networks (Levin *et al.*, 2015).

Figure 2: Main reasons for not using the Internet



Source: Statistics Canada, Canadian Internet Use Survey (2010, 2012)

Downes (2015) explains that broadband availability and price are only secondary factors, given that only about 10% of non-adopters indicate price as the main deterrent. Downes (2015, p.7) also states that a “perceived lack of relevance and a lack of technical skills are by far the most common reasons given” by non-adopters. Another Pew study (2016) indicates that almost half of the adults that do not use the Internet do not subscribe because they believe the Internet is irrelevant to their daily lives. Whalley and Sadowski (2016, p.4) show that even though various factors affect broadband adoption, not wanting a broadband connection is the reason mentioned by “almost half of those surveyed by Ofcom and two-thirds of those in the Canadian study.”¹ Whitacre and Rhinesmith (2015) determine that the three main barriers in the U. S. are cost, digital literacy, and relevance. In general, the authors conclude that the principle reasons for not adopting broadband are cost, lack of need, and inadequate computers. This study is one of very few that find cost to be a significant barrier to adoption.

¹ The Canadian study being referred to here is Haight, M. and A. Quan-Haase (2015) “Digital Inclusion Project: Findings and Implications, A Canadian Perspective,” Benton Foundation, Evanston, Illinois, available at: <https://www.benton.org/initiatives/digital-inclusion-project>.

A recent study by Tsai and Bauer (undated) reaches similar conclusions, although considering mobile broadband rather than wired broadband. Using Qualitative Comparative Analysis (QCA), the authors find that, among others, the necessary conditions for higher mobile broadband penetration include a higher level of education and more competition. Sufficient conditions, among others, that lead to higher mobile broadband penetration include higher income and greater digital skills. In fact, the Aspen Institute (2013) finds a propensity towards wireless broadband use by minorities in the U. S. and states that “if wired and wireless broadband access to the Internet are sufficiently close substitutes from the consumers’ perspective, then we can view wireless options as offering a bridge across any remaining digital divide.”

In India, Manzoor (2014, p.12) states that “broadband penetration is positively influenced by broadband service quality, knowledge, and relative advantage.” Therefore, in countries where the broadband service quality is low, consumers are more likely to adopt broadband if they are confident in the technology. The same effect was seen in Southeast Asia where Das (2013) shows that poor broadband quality and network capacity causes a negative consumer experience, which in turn lowers broadband adoption. Figure 3 shows some of the factors impeding broadband adoption in developing nations.

Figure 3: Factors affecting broadband adoption in different developing countries

Table I. Factors Affecting Broadband Adoption in Different Developing Countries.

Country	Significant factors in broadband adoption
Bangladesh	Attitude, primary influence, secondary influence, and facilitating conditions resources (Dwivedi, Khan, & Papazafeiropoulou, 2007)
Kingdom of Saudi Arabia	Usefulness, service quality, age, usage, type of connection, and accommodation (Dwivedi, Williams, Weerakkody, Lal, & Bhatt, 2008)
Pakistan	Primary influence, facilitating conditions resources, cost, and perceived ease of use (Khoubati, Dwivedi, Lal, & Chen, 2007)
India	Relative advantage, hedonic outcomes, and cost (Dwivedi et al., 2008)
Malaysia	Primary influences (PI), secondary influences, relative advantage (RA), utilitarian outcomes (UO), facilitating condition resources (FCR), and self-efficacy (SE; Ooi, Sim, Yew, & Lin, 2011)

III. Closing Another Digital Divide: Translating the Insights of the Literature into Recommendations for Government Policy and Action

Although a clear picture is emerging in the literature as to factors associated with increased broadband adoption rates, the challenge is to translate those insights into effective government policies and actions to encourage broadband adoption. While there are broadband adoption success stories such as South Korea (Atkinson, 2009), there are many more examples of government policies that appear to be weakly informed by the empirical literature and even of programs proceeding in manifest disregard for this literature. Government commitments to social tariffs and lifeline pricing for broadband provide an example of this. While price is not a significant factor explaining non-adoption (Carare *et al.*, 2015; Landry and Lacroix, 2014), governments such as the U. S. have made very large scale commitments to low-cost broadband programs with a view to increasing adoption. The literature suggests that these programs will not be effective or, to the extent that they do succeed, they will be very expensive for each additional household that adopts broadband.

Hazlett and Wallsten (2013), for example, have analyzed the effectiveness of the U. S. Federal Communications Commission's ("FCC") Universal Service Fund that in 2013 was spending nearly \$9 billion a year. They find that even with a generous estimate that 600,000 residences might have been connected as a result of the fund, the cost per home connected was \$106,000. Annual per line subsidies range up to \$10,000, although voice and broadband satellite service is available everywhere in the U. S. for approximately \$400 a year. The equity aspects of the fund are equally perverse. 80% of low income households receive no subsidy but pay the 16% tax on fixed, mobile, and VoIP service.

There is now a recognition that government broadband policies must take into account both supply-side and demand-side considerations (Hauge and Prieger, 2010; Belloc *et al.*, 2011). The implementation of demand-side measures is difficult but can have a very high impact. Such measures are difficult because they reach beyond the traditional competencies and jurisdictions of communications regulators and government communications ministries. Such bodies may be well placed to address supply-side

issues (network availability, performance, funding), but they are not well placed to deal with demand-side issues like poverty, education, digital literacy, and aging.

In a recent report, Piot & Mourad (2015) use a grid to classify nine different broadband policy measures in terms of their impact and difficulty of implementation. This is shown in Figure 4 (below), with the nine different policies being as follows:

- M1 – mobile network **sharing**
- M2 – **access** to non-telecoms infrastructure
- M3 – **spectrum** assignment
- M4 – **coverage** obligation
- M5 – mandating wholesale next-generation network (NGN) access at sustainable **price**
- M6 – measures to increase the number of **Internet** users
- M7 – measures to increase the **Internet** skills
- M8 – providing subsidies or social **tariffs** to low-income citizens
- M9 – cutting **VAT** for services in the ICT sector

Policies M1 to M5 are supply-side (blue in Figure 5), while M6 to M9 are demand-side (green in Figure 5).

Figure 4: High-level classification of suggested policies (Piot and Mourad, 2015, p. 18)

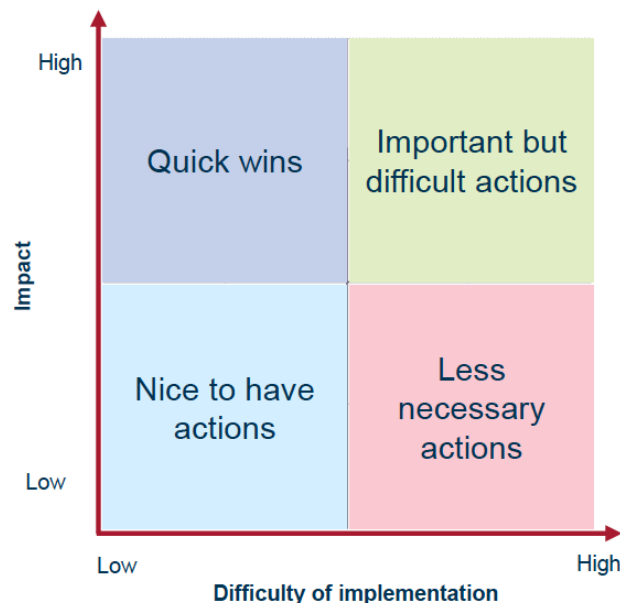


Figure 5: Classification of the suggested measures by impact on future market development and difficult of implementation (Piot and Mourad, 2015, p. 24)

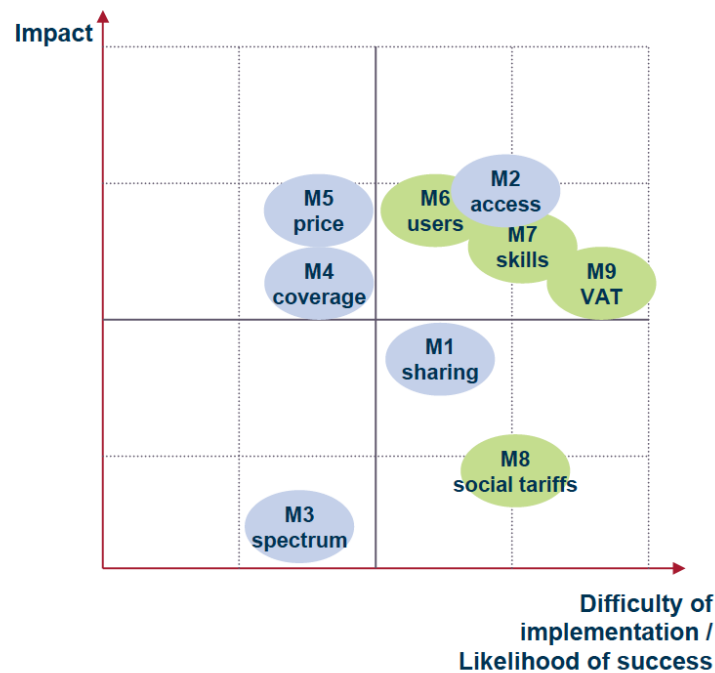


Figure 5 outlines various policy initiatives that can be equated with components of a national broadband plan. The demand-side policies, M7 Skills (digital literacy), for example, are classified as high impact but difficult to implement.

Indeed, in the case of the design of national broadband plans, effective policies to encourage broadband adoption must be directed to reducing the actual impediments that prevent people from using broadband. There are actions that policy makers can take, but they are not the often-identified simple measures such as cutting the price of broadband access. Effective policies will typically be more complex and difficult to implement, but there are some examples of the sort of policies that can be expected to work. Furthermore, these policies are often out of the sole purview of the traditional telecommunications regulator and will require coordination among multiple government agencies, including the telecommunications regulator.

IV. Some Specific Recommendations: Government Policies and Actions to Increase Broadband Adoption

Pricing Policies

The literature indicates that price is not a significant barrier to adoption. Downes (2015) explains that broadband availability and price are only secondary factors, given that only about 10% of non-adopters indicate price as the main deterrent. Such findings counsel against significant policy and resource commitments to social tariffs and broadband subsidies as a means of increasing adoption rates. Such funds could be more effectively deployed addressing more significant barriers to adoption. It is apparent, then, for example, that the FCC's new universal service program to cut the price of broadband and the Canadian Radio-television and Telecommunications Commission's ("CRTC") current consideration of various subsidy schemes to reduce the price of broadband are misguided. The FCC has committed substantial funds to reduce broadband prices, but this program can be expected to have a minimal effect on broadband adoption. Canada would face a similar inefficient outcome if it proceeds with any of the subsidy programs that have currently been proposed. These considerable resources would be much more effectively spent elsewhere to address the important impediments to broadband adoption. Canada's federal government could spend public resources with greater impact and efficiency if it focused its efforts on other drivers of broadband adoption. For example, one finding in the literature concerning ICT in rural communities in the United States found that the strongest predictor of whether an individual would adopt a specific technology was whether they used it at work (Hollifield and Donnermeyer, 2003). This suggests that government policies that increase the penetration of work of computers and broadband in workplaces – for example, through tax policies – will have an impact on broadband adoption in society at large. These types of creative – and indirect – measures will become increasingly important once the access problem is substantially addressed in developed countries.

Design of Broadband Policies

It is useful to think of broadband policies as proceeding through generations or phases. A recent ITU report distinguishes three successive phases – deployment, adoption and integration – within national broadband plans. As deployment challenges are addressed, adoption challenges and opportunities loom larger. These three phases (deployment, adoption, and integration) are outlined in Table 1 below (ITU 2015).

A key insight from this ITU report is that national broadband plans mature through phases or generations and that adoption issues must be confronted with their own sets of tools and indicators. The shift to an adoption phase, in a national broadband plan, may also signal the need for different government actors to engage.

Table 1: Successive phases of a national broadband plan

Phase	1 - Deployment	2 - Adoption	3 - Integration
Focus	Broadband network availability	Broadband access & capacity building for effective use	Broadband integration in economy and society
Examples	Optical fibre cable and wireless broadband access networks	Digital literacy programmes, community access projects & programmes	e-health, e-governance & e-commerce strategies
Indicators	Telecom	Performance	Outcome/impact measures

There is a recognition, at least in the literature, that the design of broadband policies much take into account both supply-side and demand-side factors. In developed countries, where broadband availability is now quite advanced, there is a need for a proportional shift to demand-side adoption strategies. For example, in Canada, where 99% percent of Canadians have access to broadband, but only 82% of Canadians subscribe to broadband (CRTC, 2015), the highest-impact government policies will be those that address the gap between availability and adoption. The biggest gains to advanced economies and their citizen are likely to be from increasing adoption and not from marginal increases in already widely-available broadband. Broadband success

stories, like South Korea, have placed a significant emphasis on adoption. Atkinson (2009, pp. 2-3) shows how different rates of Internet adoption in Japan versus South Korea, two countries with wide-scale broadband availability, can be explained by well-funded programs targeted, for example, to digital literacy for population groups that lag behind in terms of Internet adoption.

Government policy is often weakly focused on adoption, whereas broadband availability is typically the subject of numerous well-funded government initiatives. This is perhaps unsurprising. Dealing with demand-side measures is difficult because it engages issues (poverty, literacy, aging) that transcend the expertise and jurisdiction of communications regulators and policy-makers. This challenge is amplified by the fact that no single government player, acting on its own, can address the factors influencing adoption. A coordinated approach across levels and areas of government is required. Initiatives like Comcast's Internet Essentials program represent a large scale attempt to simultaneously address many of the factors influencing broadband adoption by providing eligible low-income families, across the United States, with a low-cost computer, a low-cost broadband connection, and digital literacy training.² Similar initiatives are being developed by broadband providers in Canada.

In developed countries that exhibit high broadband availability, remaining initiatives to expand broadband access are usually focused on rural and remote areas, as those are the areas where broadband is not available or where broadband speeds are slow. These areas often present acute difficulties for the deployment of networks – challenging topography, low population density, etc. These network deployment challenges are matched by adoption challenges. Broadband adoption tends to be lower in rural areas, and income and educational attainments may, on average, be lower as well. This suggests that any decision to deploy networks in these areas must be accompanied by a broadband adoption strategy to ensure that high network deployment expenditures are matched with effective subscriber uptake.

² Comcast, "Comcast Extends National Broadband Adoption Program for Low-Income Families," Press Release, March 4, 2014, Washington, D. C., available at https://internetessentials.com/sites/default/files/news/ie_progress_report_press_release_030314_final.pdf

Furthermore, there are *indirect* demand-side actions that can increase broadband adoption. For example, someone who uses the Internet at work is more likely to want and have the skills to adopt broadband at home. Research that investigated the diffusion of ICT in rural communities in the United States found that the strongest predictor of whether an individual would adopt a specific technology was whether they used it at work (Hollifield and Donnermeyer, 2003). This suggests that policies that put more computers into workplaces can be expected to increase household broadband adoption. Similarly, telecommuting has been found to increase household broadband adoption. A recent study found that one of the most important drivers of increased metropolitan broadband adoption in the United States was the share of telecommuters in a particular area (Tomer and Kane, 2015). The same may be true for families with children in school. More use of computers at schools will encourage families to adopt broadband at home. These studies suggest that governments wanting to encourage broadband adoption in society at large can start at a more micro level by developing policies that encourage the use of computers in workplaces and schools.

Another example relates to lower-income groups, in developed countries, that may choose between a wireline and a wireless telephone because of cost. The choice is often for a wireless telephone. Policies focused solely on wireline broadband availability and adoption will not reach this group of potential broadband adopters. For these individuals, policies would need to be directed at mobile broadband and the need for the skills required to use mobile broadband. Policy-makers need to recognize mobile broadband is increasingly a platform for addressing the digital divide. This is true for certain sub-groups in developed countries and, of course, all the more so in developing countries where mobile networks may be the primary phone networks for many communities (Aviles, Larghi, et al, 2016). Policy-makers need to focus and calibrate their policies and actions accordingly. This means, for example, that government agencies measuring broadband adoption must take into account mobile options. Further, policies aiming to boost adoption cannot solely focus on wireline networks.

Regulatory Policies, Competition and Broadband Adoption

Facilities-based competition, also referred to as platform competition, for broadband service has been shown to increase adoption, probably as a result of strong competition among or between facilities-based providers (Crandall *et al.*, 2013). A national government that is seeking to increase broadband adoption rates should not, at the same time, be pursuing broadband unbundling policies. The two programs work at cross purposes. Put otherwise, there must be a coordination of efforts between broad government policies (aimed at increasing broadband availability and adoption, for example) and more narrow, sector-specific policies, like regulator-led unbundling of broadband networks. The encouragement of platform competition (including via spectrum policies and competition law policies) can increase adoption rates.

The large-scale benefits of broadband adoption, coupled with the multi-dimensional nature of the challenge (age, income, education, digital skills) call forth the need for a transcendent point of coordination of government and private sector actions. The challenge of broadband adoption is bigger than the mandate of a typical national regulatory authority or government ministry. Given this, and absent some higher level, national coordination, broadband adoption plans will fall short of their promise, and programs and policies may work at cross purposes, as is the case with policies aimed at unbundling networks, which are associated with lower rates of adoption. In Canada, for example the federal government is expending public funds to build broadband networks while, at the very same time, its communications regulator, the-CRTC, is pursuing policies of forced sharing of competitively supplied broadband networks provided by cable and telephone companies that have been shown to suppress investments and negatively impact adoption. It is challenging to see how these two policies can responsibly or coherently co-exist given that the one (funding broadband expansion) is undermined by the other (unbundling of broadband networks). In addition, macro-economic policies are important because full employment and increasing productivity will boost incomes and improve labor market skills, spurring broadband adoption.

V. Conclusions

As the availability of broadband becomes more ubiquitous, as is the case in many developed countries with advanced telecommunications infrastructure, the focus should switch to demand-side policies designed to increase broadband adoption, which typically lags behind broadband availability. It is these policies which will have the biggest payoff in terms of individuals, the economy, and society; marginal increases in availability will be costly and will have much less of an effect. Such adoption policies require a multi-agency, coordinated approach.

Such demand-side policies are more difficult to implement successfully than simply extending broadband networks. Demand-side policies must address impediments to adoption, including age, income, education, and digital literacy. This requires a coordinated multi-agency approach that also may need to involve the private sector. This sort of coordinated effort is often difficult for governments to undertake, as it is not generally clear which agency should be in charge of coordinating any efforts, but it is precisely these sorts of policies and programs that are needed for continued broadband progress.

References

- Anderson, G. and J. Whalley (2015), "Public library internet access in areas of deprivation: The case of Glasgow," *Telematics & Informatics*, Vol.32 (3), pp. 521-537.
- The Aspen Institute (2013), "Roundtable on Spectrum Policy 2013 Report," Chapter III - Wired and Wireless Substitution, Competition and Complementarity.
- Atkinson, Robert D. (2009), "Policies to Increase Broadband Adoption at Home," (November 2009), <http://www.itif.org/files/2009-demand-side-policies.pdf>.
- Aviles, Judith Mariscal, S.B. Larghi, M.A.M. Aguayo (2016), "The informational life of the poor: A study of digital access in three Mexican towns", 40(7), *Telecommunications Policy*, pp. 661-672.
- Canadian Radio-television and Telecommunications Commission (CRTC, 2015), "Communications Monitoring Report," 2015.
- Belloc, Filippo, Antonio Nicita, and Maria Alessandra Rossi (2011), "The Nature, Timing and Impact of Broadband Policies: a Panel Analysis of 30 OECD Countries," *Universita degli Studi di Siena*, N. 616, Luglio 2011.
- Carare, Octavian, Chris McGovern, Raquel Noriega and Jay Schwarz (2015), "The willingness to pay for broadband of non-adopters in the U.S.: Estimates from a multi-state survey," *Information Economics and Policy* 30, pp.19 – 35.
- Chaudhuri, Anindya, Kenneth S. Flamm and John Horrigan (2005), "An Analysis of the Determinants of Internet Access," 29 (9-10) *Telecommunications Policy*, pp. 731-755.
- Crandall, Robert W. (2015), "The Performance of the Canadian Telecom Sector: A Policy Perspective," submitted to the Canadian Radio-television and Telecommunications Commission, First Intervention by TELUS Communications Company, Appendix A, Telecom Notice of Consultation CRTC 2015-134, *Review of basic telecommunications services*, CRTC File No.: 8663-C12-201503186, July 14, 2015.
- Crandall, R, Eisenach, J, and Ingraham, A (2013), "The long-run effects of copper-loop unbundling and the implications for fiber," *Telecommunications Policy*, 37, 262-81.
- Crawford, Susan and Scott, Ben (2015), "Be Careful What You Wish For: Why Europe Should Avoid the Mistakes of US Internet Access Policy," June 2015, stiftung neue verantwortung.
http://www.stiftung-nv.de/sites/default/files/broadband.eu_usa_0.pdf.

- Das, Sanchita Basu (2013), “Enhancing ASEAN’s Connectivity,” Institute of Southeast Asian Studies, <https://books.google.com/books?hl=en&lr=&id=RRvGp-VBvHEC&oi=fnd&pg=PA72&dq=broadband+adoption+asia&ots=EBXnmHLjZ&sig=d3tX84CrMt0F1jBar2rMA0YPMo8#v=onepage&q=broadband%20adoption%20asia&f=false>.
- Downes, Larry (2015), “How to Understand the EU-U.S. Digital Divide,” October 19, 2015, *Harvard Business Review*, 2015. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2728759.
- Ehrlich, Everett (2014), “The State of U.S. Broadband: Is it Competitive? Are We Falling Behind?” Progressive Policy Institute. http://www.progressivepolicy.org/wp-content/uploads/2014/06/2014.06-Ehrlich_The-State-US-Broadband_Is-it-competitive-are-we-falling-behind.pdf
- European Commission (2014), “Scoreboard 2014 - Trends in European broadband markets 2014,” May 28, 2014. <https://ec.europa.eu/digital-single-market/news/scoreboard-2014-trends-european-broadband-markets-2014>.
- FCC (2015), “2015 Broadband Progress Report And Notice Of Inquiry On Immediate Action To Accelerate Deployment,” January 29, 2015. https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-10A1.pdf.
- Hazlett, Thomas W. and Scott J. Wallsten, “Unrepentent Policy Failure: Universal Service Subsidies in Voice & Broadband,” Arlington Economics, June 2013.
- Hauge, Janice and James Prieger (2010), “Demand-Side Programs to Stimulate Adoption of Broadband: What Works?” 14 October 2009, <http://ssrn.com/abstract=1492342>, p. 4. [Published in *Review of Network Economics*, Vol. 9, No. 3, Article 4, 2010.]
- Hollifield, C.A. and J.F. Donnermeyer (2003), “Creating demand: influencing technology diffusion in rural communities,” *Government Information Quarterly*, Vol. 20(2), pp. 135-150).
- Holmes, Allan and Zubak-Skees, Chris (2015), “US Internet Users Pay More and Have Fewer Choices Than Europeans,” 1 April 2015, The Center for Public Integrity. <http://www.publicintegrity.org/2015/04/01/16998/us-internet-users-pay-more-and-have-fewer-choices-europeans>.
- ITU (2015: 31) *The state of broadband 2015*, ITU, Geneva, Switzerland.
- Karine M. Landry and Anik Lacroix (2014), “The Evolution of the Digital Divides in Canada,” 2014 TPRC Conference Paper.

- Kehl, Danielle, Russo, Nick, Morgus, Robert, and Morris, Sarah (2014), “The Cost of Connectivity 2014,” October 30, 2014, Open Technology Institute.
<https://www.newamerica.org/oti/the-cost-of-connectivity-2014/>.
- Landry, Karine and Anik Lacroix (2014), “The Evolution of Digital Divides in Canada,” *2014 TPRC Conference Paper*, August 15, 2014.
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2418462.
- Levin, Stanford, Stephen Schmidt, and Graham Scott (2016), “Broadband for All: Policies for a Connected Society,” presented at the “The Intelligent World: Realizing Hopes, Overcoming Challenges,” ITS Regional Conference, Los Angeles, October 25-28, 2015, and at “Competition and Regulation in Infrastructure and Digital Markets,” Florence School of Regulation Annual Scientific Seminar on the Economics, Law and Policy of Communications and Media, 6th edition, March 18-19, 2016.
- Manzoor, Amir (2014), Investigating the Factors Affecting Residential Consumer Adoption of Broadband in India,” *Sage Open*, October-December 2014: 1-17.
<http://sgo.sagepub.com/content/4/4/2158244014556998.full-text.pdf+html>.
- National Telecommunications and Information Administration, U.S. Department of Commerce (2013), “Exploring the Digital Nation – America’s Emerging Online Experience,” June 2013.
https://www.ntia.doc.gov/files/ntia/publications/exploring_the_digital_nation_-_americas_emerging_online_experience.pdf.
- National Telecommunications and Information Administration and U.S. Department of Commerce (2014), “Exploring the Digital Nation: Embracing the Mobile Internet,” October 2014.
https://www.ntia.doc.gov/files/ntia/publications/exploring_the_digital_nation_embracing_the_mobile_internet_10162014.pdf.
- OECD (2015), “OECD Digital Economy Outlook 2015,” OECD Publishing, Paris.
<http://dx.doi.org/10.1787/9789264232440-en>.
- Ofcom (2015), “The Communications Market Report,” August 6, 2015.
http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr15/CMR_UK_2015.pdf.
- Pew Research Center (2014), “Usage and Adoption,” April 3, 2014,
<http://www.pewinternet.org/2014/04/03/usage-and-adoption/>.
- Pew Research Center (2015), “Broadband vs. Dial-up Adoption Over Time,”
<http://www.pewinternet.org/data-trend/internet-use/connection-type/>.
- Pew Research Center (2015), “Home Broadband 2015,” December 21, 2015.
<http://www.pewinternet.org/2015/12/21/home-broadband-2015/>.

- Pew Research Center (2016), “Broadband Technology Fact Sheet,” last accessed April 7, 2016 at <http://www.pewinternet.org/fact-sheets/broadband-technology-fact-sheet/>.
- Piot, S. and S. Mourad (2015: 18) *Report for the Broadband Commission – Broadband Policy Briefing Paper*, 22 September, Ref: 2004783-393, available at www.analysysmason.com.
- Robertson, Alastair, Soopramanien, Didier, and Fildes, Robert (2007), “Segmental new-product diffusion of residential broadband services,” *Telecommunications Policy* 31, pp. 265-275.
<http://www.sciencedirect.com/science/article/pii/S0308596107000213>.
- Tomer, A. and J. Kane (2015), “Broadband Adoption Rates and Gaps in US Metropolitan Areas,” December 2015, Metropolitan Policy Program, Brookings, Washington DC, USA.
- Tsai, Hsin-yi Sandy, and Johannes M. Bauer, “Designing Workable Mobile Broadband Policies: Theory and Evidence,” unpublished manuscript.
- Whalley, Jason and Sadowski, Bert (2015), “Innovation and the development of a digital economy: assessing the socio-economic effects of broadband,” submitted to the Canadian Radio-television and Telecommunications Commission, Response of TELUS Communications Company, Appendix A, Telecom Notice of Consultation CRTC 2015-216, *Review of wholesale wireline services and associates policies*, CRTC File No.: DGTP-002-2015, November 21, 2015.
- Whalley, Jason and Sadowski, Bert (2016), “Why do individuals adopt broadband?” prepared for the Canadian Ministry of Innovation, Science, and Economic Development.
- Whitacre, Brian and Rhinesmith, Colin (2015), “Broadband Un-adopters,” *Telecommunications Policy* 40, pp. 1-13.