

8 Insight into the Economics of ‘Broadband’

In preparing the economic analysis for this Assessment, an economist based in NWT reviewed relevant literature from other jurisdictions and countries faced with similar challenges as the Canadian Arctic, and reviewed background documents specific to the telecommunications industry.

‘Broadband’ is the term used in many of the international documents use to signify a high data rate connection to the Internet, also referred to as ‘high speed Internet’.

‘Broadband’ refers to a digital network infrastructure that is able to carry all manner of communications in a society where communications services have converged, and focuses on the services accessible to the end user. Broadband in this context includes mobile communications.

Because the economics review in this Assessment references international studies, this part of the report will use the term ‘broadband’. For the purposes of this section, we use ‘broadband’ as essentially equivalent to ‘communication infrastructure’ used in other parts of this Assessment. (Traditional analog phone services and analog HF radio infrastructure is not included in the term ‘broadband’.)

8.1 Introduction

It has become almost passé to talk about the role of broadband in the growth and prosperity of a modern society. It is quite simply understood as a necessity. Whether related to trade and commerce, education or health, government services, knowledge transfer or general enlightenment, social networking, or simply entertainment, we find that broadband is a deeply rooted part of our lives, our sustainability, our happiness. This is as true for someone living in London, Paris, or New York as it is for someone living in Dawson, Tuktoyktuk, or Repulse Bay. Our interest is, of course, the role of broadband in the latter communities where it can be argued that in relative terms it is more important for the quality of life and perhaps even the long-term survival of these communities. In the first section of this chapter of our report, the role of broadband in the economic development and sustainability of our northern communities is discussed.

But there is another side to the economics of broadband, one that is far more complex, especially as it relates to the northern context of this report. It is perhaps ironic that the true economic challenge for broadband and other communication infrastructure products is not in the ability or manner in which society will adapt to and make use of it, but rather the manner in which our markets have developed in selling these products and services to consumers.

The three territories represent a difficult environment in which to operate. They are characterized by a small consumer base located across a vast geographic range. A harsh climate and poor and sometimes absent community and transportation infrastructure further hinder development. Within the three territories are vastly different economic

conditions such as the differences in road access, degrees of remoteness, and size of communities. This all makes the North an unprofitable marketplace for communications service providers. Nevertheless, suppliers of broadband do operate on somewhat of a competitive basis, but a majority of that competition is for government subsidies.

Regulators must take these market conditions into consideration when outlining the rules in which the industry will operate. Between the market players and its regulators, an answer must be found for the growing demand from government and the general public for bigger, better, and faster Internet services. Meeting this demand will mean more innovation and large capital investments. How to facilitate these needs within an unprofitable marketplace where consumers cannot possibly afford to bear the associated costs is an enormous challenge. It will require unraveling the complex system in which these elements (competition, subsidization, innovation, and regulation) combine to create the northern marketplace.

This section offers a overview of the role of broadband in the pursuit of a higher quality of life, its role of developing sustainable communities, and provides a snapshot of the Territorial economies. In Section 8.5, we outline the market challenges, looking at the roles of competition, regulation, subsidization, and innovation in an effort to bring some clarity to the discussion on building an infrastructure for 21st century access.

Finally, the section wraps up with conclusions and recommendations from an economic point of view for a path forward.

8.2 The Role of Broadband in the Pursuit of a High and Sustainable Quality of Life in Canada's Territories

Internationally it is recognized that broadband access is significant to the development of a sustainable society.

IT use is considered not just a part of everyday life for most businesses, organizations and citizens, but also has an impact on growth, competitiveness and the development of a sustainable society. As already outlined in this report, more and more services are becoming digital, requiring businesses and households to be able to make use of these services. Northerners, just as all Canadians, must be connected in order to accomplish simple tasks such as financial reporting and banking.

In Sweden, policy makers see ease of access as a matter of democracy and rights. It's a matter of everyday life that it works smoothly so that people are able to shop, do business, keep in touch with friends and family, watch video clips or express opinions or comment on events and issues that affect them. This necessitates having access to broadband that makes it possible to connect to the Internet securely. (Government of Sweden, 2010, page 13)

Most recently, the United States released its National Broadband Plan which stated that

"...like electricity a century ago, broadband is a foundation for economic growth, job creation, global competitiveness and a better way of life. It is enabling entire new industries and unlocking vast new possibilities for existing ones. It is changing how we educate children, deliver health care, manage energy, ensure public safety, engage government, and access, organize and disseminate knowledge." (Federal Communications Commission, Exec Summary page XI)

The American plan concluded that broadband is the great infrastructure challenge of the early 21st century.

If smooth-running, easy access to broadband for all citizens is considered a matter of democracy and rights, and is characterized as "the great infrastructure challenge of the 21st century" in other countries, there is certainly work to be done in the Arctic.

It is clear from the data in this Communications Assessment, that Arctic residents do not have adequate access to broadband services, and the gap continues to increase as more services are delivered via broadband networks everywhere. The GNWT, in its submission to the CRTC stated that

"As Canadians become ever more reliant on the Internet, this phenomenon will, if allowed to continue, result in the residents of rural and remote Canada becoming second class citizens who are increasingly disenfranchised from meaningful participation in Canadian society and the economy." (GNWT, 2010, page 6).

This would be contrary to the most fundamental values of Canadians as reflected in the objectives of the *Telecommunications Act*, most particularly objectives (a), (b) and (h) of section 7 which provide that:

It is hereby affirmed that telecommunications performs an essential role in the maintenance of Canada's identity and sovereignty and that the Canadian telecommunications policy has as its objectives

(a) to facilitate the orderly development throughout Canada of a telecommunications system that serves to safeguard, enrich and strengthen the social and economic fabric of Canada and its regions;

(b) to render reliable and affordable telecommunications services of high quality accessible to Canadians in both urban and rural areas in all regions of Canada;.....

(h) to respond to the economic and social requirements of users of telecommunications services. (GNWT, 2010, page 6)

In this chapter, the role of broadband in the development of Canada's northern most communities is discussed.

8.3 Community Sustainability

The Internet has become a necessity of life for much of the world's populations. Northern Canadians are no exception.

Internet services make northern, remote and isolated communities more sustainable and will aid in their long-term survival. IT and good electronic communications are essential for business, employment and efficient administration; all key components that increase the likelihood that people will live in remote communities.

Over the next 10 to 20 years, the territorial economies will grow significantly (see Section 8.4), contributing a larger portion of the nation's overall wealth.

Some of the growth and the socio-economic changes that it brings will affect and be affected by Internet services:

- population changes (most pronounced in Nunavut) will create greater demand;
- the development of mineral deposits throughout the North will mean more industrial demands for Internet services, generate greater wealth for Northerners who will spend it in part on or through the Internet;
- climate change and its impacts on (among other things) marine transportation through the Northwest Passage;
- sovereignty issues.

Despite the growing economy or perhaps because of it, there are real threats to the sustainability and survival of northern communities. Communication infrastructure can play an important role in mitigating these threats, such as:

- slowing Arctic deruralization (the outflow of people from smaller to larger centres);
- assisting business development;
- benefiting government service delivery.

Slowing Arctic deruralization and out-migration

If Canada wants vibrant Arctic communities, efforts must be made to improve their attractiveness to the people who live there. We heard from participants in workshops in Iqaluit that educated young people today are less likely to remain in an isolated community that has no physical or virtual link to the outside world.

Many Arctic communities were established on the basis of fur trading or mining, or were otherwise residential and/or administrative centres, established by the church or the government. With the fur trade gone as a viable economic pursuit, and old mines in Yukon and Nunavut decommissioned long ago, the sustainability of some communities is questionable, especially for those without a large government presence and those untouched by recent resource developments. These communities are very expensive to maintain from the perspective of public finance and given the absence of known

marketable assets this fact is unlikely to change. The unemployment rate in some communities exceeds 30 per cent.

Even for communities that can participate in the mining sector through the fly in/fly out work rotation, some people will be less inclined than others to pursue this. Not everyone can be a miner, or can tolerate being away from their families half the year. What's the future for these people and their communities? How long can they continue to exist?

But there are other considerations when discussing why and how Arctic communities can survive and thrive. We assume that Canada is 100% committed to Canadians living in these communities. Canadian sovereignty over the Arctic region is based largely on these people who live in remote and strategic areas and will continue to do so. In fact, some Arctic communities were created by the Canadian government specifically for the purpose of sovereignty. The federal government's Northern Strategy highlights all of these important points:

- Canada's Arctic communities are a major factor in our sovereignty claims;
- there is tremendous wealth in the natural resources found throughout the Arctic;
- there is a real opportunity for the Northwest Passage to become an international trade route; and,
- the Arctic is an important symbol of Canadian identity.

Regardless of how these communities are viewed politically or strategically, the sustainability and even existence of some are in jeopardy. Many are suffering from out migration of residents, particularly young and educated residents, who are moving to larger centers. This is a world-wide phenomenon known as "deruralization".

Deruralization is a term most Canadians associate with the movement of people away from rural farming communities and into larger metropolitan cities. It creates economic hardship on the small communities because of the lost tax base, fewer children to fill the local school, less commercial activity and reduced civic activity. Many of these communities have simply vanished or are now mostly residential areas in the country offering few if any services. Deruralization, though, is not a term specific to rural farming communities, but rather is a reference to the movement of people away from small, rural communities because of declining economic and social attractiveness of these towns. Canada's northern communities will not escape this trend.

There are no statistics available to confirm the impact of Internet on demographic movements, but we can assume that it is less attractive for young people to live in a community without access. To move to a remote community that is without modern communication infrastructure, namely broadband but also things such as cellular phone coverage, is akin to moving to a community in the 1980's that was still without telephone access. Few people would choose to make that move.

The prospect of moving to a remote or isolated community in Canada's territories can be enhanced by the existence of broadband. The remote communities in all three territories struggle to attract and retain doctors, nurses, teachers, engineers, and others. For these professionals, modern communication infrastructure means they can do their job and enhances their private life as well. In the same way that business investment will gravitate toward geographic locations that offer advanced Internet services, so will people.

Internet access is making life in communities increasingly livable, which should be a positive for net migration. Community life is improved through better communications with family members and friends, through the provision of entertainment and social networking, and access to shopping. While online shopping access is convenient in southern locations, for communities with only one small store, online shopping is the way to get a wide range of products. The interest in purchasing products online will only grow, especially in communities that are benefiting from resource development and where people have more money to spend. Without these modern conveniences, people with money in these remote locations are more likely to leave. Left unchecked, this out-migration will slowly drain these communities of their most valuable resource; the people who live there.

Business development

Several studies show that investments in IT and broadband have been favourable for social development and that countries that have invested heavily also have experienced higher productivity. The competitiveness and productivity of businesses can consequently increase through more efficient production of goods and services, logistics and new business processes. Collaboration is made easier. (Government of Sweden, 2010, page 5). Access to broadband makes it easier to work remotely. It enhances the possibility of launching and running a business from anywhere. It can reduce and sometime eliminate the need for travel. It means that people are able to work where they live instead of having to live where they work.

It is a major challenge for businesses to keep up with the changes resulting from technological advances, but by doing so a business can lower its costs and improve its competitiveness. In rural areas, poor access can leave businesses without any possibility of achieving these advances and in actuality, businesses won't even know what is possible or the extent to which they are disadvantaged in terms of their technological efficiencies. Businesses in Canada's territories will always have to contend with the physical realities of their operations, but higher-quality access to services through the Internet can help compensate for that.

Broadband can have a profound impact on how a community can benefit from economic opportunities

- Economic growth can mean business opportunities through joint venture or otherwise. Communications is a key element to any business, especially

partnerships. Communities with poor communication links will be at a disadvantage;

- For many communities, postal service, facsimile and memory sticks on airplanes are still the preferred communication modes since secure Internet service is often inadequate and large file transfer impossible. This can slow the speed of business, can be frustrating, and can cause disruption to communications on important issues;
- With the rest of the world working at broadband speeds, communities that are cut-off will not be desirable places for business;
- For the smallest and most isolated communities, their Development Corporations or Joint Ventures would be well advised to have their principal office of business in a location where modern communication infrastructure exists. This robs the community of an opportunity to improve its wealth and sustainability.

Benefits to government service delivery

There are three principal ways government benefits from broadband services into communities:

1. Day-to-day administration costs are reduced;
2. Enables government to provide essential services;
3. Improves the safety and security of the communities.

Internet services can lower the day-to-day cost of administration

So much of government's service approach assumes broadband into homes. When this infrastructure is not in place, these services must be conducted in a manner that is more expensive and labour intensive. It also means government must maintain two systems: one for those with broadband and one for those without. This duplication adds to the operating cost of government. It is made more expensive when a public servant must physically travel to a community to complete their business that could otherwise be conducted through the Internet.

In Nunavut, the government operates under a decentralized model of public administration. However, poor Internet service can be blamed in part for problems in the GN's operations. Its inability to use the Internet for large file transfer or for secure files has meant many government functions are still being carried out by hand-written logs. An example of this is the Department of Health, which does not yet use modern electronic filing systems for maintaining portions of its records. Not only is their system inefficient, but it can result in errors or lost information, and restricts the ability to investigate the economics of the department. Another example relates to the much-publicized Nunavut Housing Corporation \$110 million shortfall in the Nunavut Housing Trust initiative. A portion of the problem which resulted in this error is said to be the lack of capacity to complete large file transfers from Arviat to Iqaluit.

The lack of broadband infrastructure in remote communities in the North also increases the cost of education and health services. In both cases, broadband can have an enormous positive influence on public expenditures, with obvious benefits to children and patients.

- Children can remain in their home community to complete their education. This greatly increases their chances of graduating and would allow them to receive skills training via distance education. The benefits to the individual, society and government when children are educated are significant and long term.
- Patients can receive care without having to wait for a traveling doctor or to physically travel to the nearest health centre themselves. The per capita spending on health is highest in Nunavut at \$11,811, followed by NWT at \$9,906, then Yukon at \$8,013. In Canada as a whole, per capita spending is \$5,452, less than half of what it is in Nunavut.
- Health care costs related to travel in the North are astronomical. In Nunavut, capital costs and travel (one category) eats up 29.5 per cent of the entire health budget. For the rest of the country, this line item requires 14.4 per cent of the health budget because very little goes toward travel.

The provision of essential services to all citizens

There should no longer be any debate over whether high speed Internet service should be a public good. It might be expensive, but the reality of our world is what it is, and it includes Internet service for all.

We have reached a point in the development of modern communications that the Internet is a part of our democracy. The Internet allows people to become engaged in debate and affect political change. In the recent election held by Nunavut Tunngavik Inc., candidates for president made extensive use of FaceBook and Twitter to lay out their platforms and engage the electorate.

In Australia, the government is investing \$43 billion over 8 years through its National Broadband Network to bring an advanced, fast and reliable Internet backbone to the entire country that will include 12 Mb/s at a minimum to the most rural and remote regions of their country. (National Broadband Network, 2010a, page 1). Meanwhile, the US Federal Communications Commission is spending \$4.3 billion for broadband deployment and support for rural and remote regions of the country in order that they can communicate effectively and efficiently (ITWorldCanada, 2010). These are signs that the rest of the world is making the investments to ensure their citizens' basic needs are met.

Very soon, social pressure will be too great for government to not act, so a clear plan in this regard will save millions in the near future.

Meeting safety and security needs

Residents in Canada have the right to feel secure in their own community, regardless of where they live. Communication infrastructure is playing an increasingly greater role in the provision of safety and security everywhere, including the Arctic.

With all the national and international debate over Arctic sovereignty, one might see security in that context only when in fact there are many aspects to safety and security that should be considered. One should think in broad terms when thinking safety and security. It can apply to national, regional, community or individual threats. Threats can be related to violence, property, extreme weather events, natural disasters, climate change, disease outbreaks (including pandemics) or international security threats.

There are endless examples to draw from. The fallout from Operation Nanook related to communications in the eastern Arctic was presented earlier. The need for modern, secure communication infrastructure has a significant value to national defence and Canada's Arctic sovereignty claims. But there are other stories of a break-down in communication links in Yukon and the NWT that could have resulted in real threats to people's safety and security had the timing of those events coincided with a natural disaster of some sort.

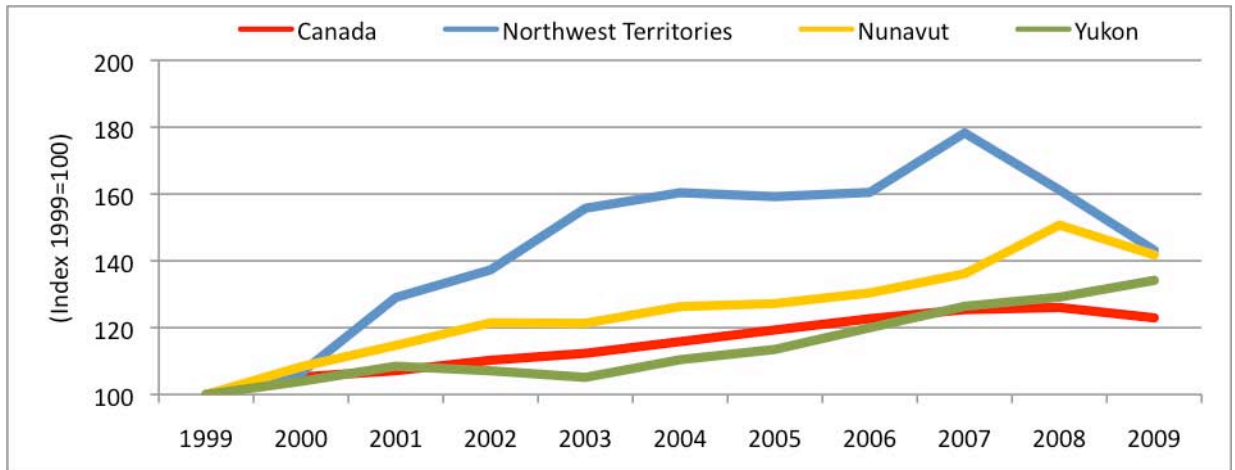
On a smaller scale, there are people in remote communities who are victims of domestic violence that feel unsafe because they cannot have call-display on their phones. During the SARS threat in 2007, we heard that a remote community without cellular coverage grew scared when they lost phone service for a short period of time and had no way of calling for a medical evacuation had they needed it. It doesn't matter that the SARS threat was not serious in the end. What matters is that over a hundred people were cut-off at a time when it was believed to be serious.

Government's responsibilities in preparing for and dealing with threats rely heavily on all aspects of the communications infrastructure. It is yet another area where public demands for this infrastructure and service will continue to grow.

8.4 Territorial Economics

The economic outlook for Canada's territories, if taken as a whole, is very positive. Much of this growth will come from resource extraction, but increased interest from the federal government in seeing the region developed may mean new opportunities for economic growth will emerge. Already, the territorial economies are growing faster than the Canadian average. (See Chart)

Gross Domestic Product, Chained (2002) dollars, Index 1999=100



Source: Statistics Canada, Economic Accounts Division

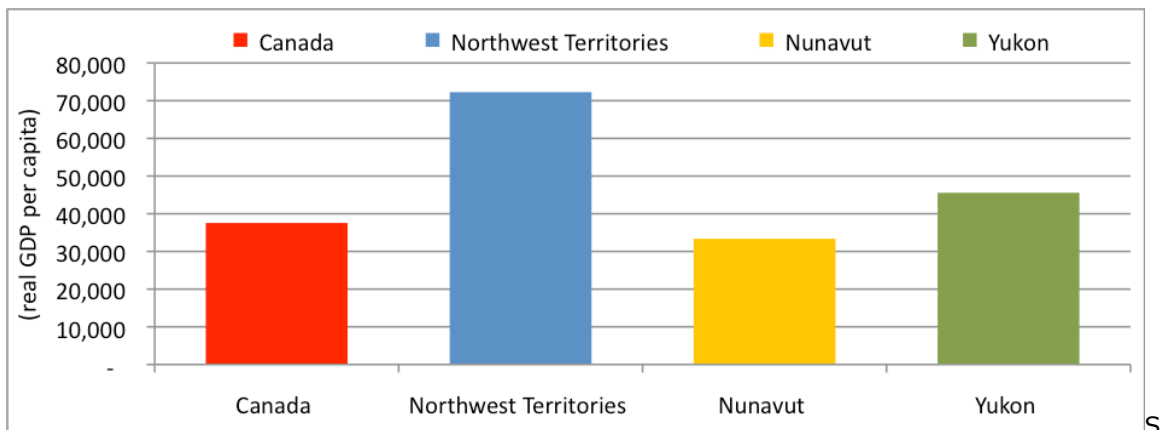
Mining and gas

In the NWT, a major economic transformation has taken place, which began in 1997 with the development of BHP Billiton's Ekati Diamond Mine. Since that time, two more diamond mines have opened—Rio Tinto's Diavik Diamond Mine and De Beers' Snap Lake Diamond Mine.

The pace of development in Nunavut and Yukon is now picking up as well. Resource development will add substantially to the employment and personal income levels in both of those territories.

As it stands today, the GDP per capita in the North is well above the Canadian average in the NWT and Yukon, and within a few years the same will be true in Nunavut. (See Chart)

Gross Domestic Product, Chained (2002) dollars per capita



Source: Statistics Canada, Economic Accounts Division and Demography Division

Resource development will continue in all three territories. In the next ten years, as many as 10 mines could open. The single largest project would be the Mackenzie Gas Project (MGP) if it is developed. The MGP would attract \$16 to \$50 billion in direct investment (depending on the development scenario) and generate \$32 to \$118 billion in revenues. (Wright-Mansell, 2007, page 3) British Petroleum, Imperial Oil and ExxonMobil have purchased exploration licenses in the Beaufort Sea for a combined price of \$1.8 billion. The interest in these properties is very likely oil rather than natural gas, so their development does not hinge on the fate of the MGP. Yukon could have 5 or 6 mines operating in the coming years. There are two new mines in advanced stages of their environmental assessment in the NWT. And in Nunavut, there are at least two new properties that will be operating five years from now and another 3 with very good chances of being developed by 2020.

Under a full-growth scenario where all of the mineral deposits in advanced stages of exploration and regulatory approval were to open by 2020, one could expect the combined GDP for the territories would double in that time.

Climate change, sovereignty, and other economic opportunities

Other sectors of the economy are smaller but still important.

Tourism is a major component of Yukon's economy, and is growing in Nunavut, especially in areas such as cruise ships due to the decrease in summer sea ice. This decrease in sea ice will also result in more marine traffic through the NW Passage, though it will be sporadic for the next decade or more (Arctic Council, 2009).

Commercial fishing in Nunavut is still small in terms of overall employment and GDP, but is growing through substantial investments in infrastructure and training (Impact Economics, 2010)

National issues related to climate change and sovereignty have increased the territories' exposure across Canada, and with it, increased investment from the federal government. It is not possible to put a dollar value on this heightened exposure, but it does signify a greater awareness of the performance and potential of the North.

Today, thousands of passenger airplanes and dozens of ships pass through Canada's Arctic every year. As climate change makes the North more accessible, it also increases the risk for a major air or shipping disaster. Canada is about to sign an international treaty obliging it to take responsibility for a vast section of the Arctic, and will be responsible for monitoring the region and providing search and rescue services. This is an important sovereignty issue, directly related to the impact of climate change. This activity also increases job opportunities for many northerners, with increased military activity, environmental stewardship, and even Ranger patrols.

Underpinning all three economies is stable financial support from the federal government through the Territorial Formula Financing agreements. The large governments in all three

territories (large relative to the overall economies) provides a lot of security to the economies which would otherwise be vulnerable to the boom-bust cycles experienced by regions where mining is the only major economic contributor.

Labour and the social economy

All of these growth opportunities will create a demand for labour and business that far exceeds what the three territories can supply, thus creating opportunities for increased wealth for people outside the territories as well as those within. But while these opportunities are looming in the near future, there continues to be a serious challenge in bringing the North's social economy along at the same pace of growth.

The divergence in growth paths; that is, the rate at which the economy is growing versus the rate of social progress, is so great that it threatens the long-term sustainability of the North. This is less the case for Yukon which has a vastly different demographic makeup than NWT and Nunavut.

This gap between the social economy and GDP is most evident in Nunavut, where the separation between rich and poor is becoming increasingly pronounced as a result of the new economy creating winners and losers from within the labour market (Impact Economics, 2010). It is a reality that not all northerners are equally ready, willing and able to participate in the types of economic opportunities available. And to date, no clear solution has been found to help these people.

Finding a way to ensure the wealth from resource development benefits all of society is the single greatest economic challenge the North faces.

Failure in this regard will condemn many northerners to a life of poverty and will prolong the financial challenges these communities and individuals represent for northern governments. Simply put, if resource development (notwithstanding the pockets of economic growth in other sectors that can and will occur) is to be the economic driver of the three territories over the next 20 years, then it must be that policies and programs are put in place that allows everyone access to a better quality of life.

It is clear northern economies are very strong and are getting stronger. It is also very clear the challenges the North face are not economic, but social. Broadband-enabled services have a very significant role to play in ensuring a higher quality of life while helping to build and maintain sustainable communities and lessening the digital divide.

There is a strong argument to be made that significant IT investments would do more than any other form of physical investment to assist in developing the social economy and addressing the issues of deruralization, poverty, and sustainability challenges facing many Arctic communities.

8.5 The Market Challenge for Communication Infrastructure in Canada's Territories

Most literature on the subject of the economics of communications infrastructure and broadband services emphasizes the importance of competition. The need for quality Internet services is so great in the context of the world's economy that it is shaping the international flow of investment capital. Money now flows toward regions of the world that offer a quality Internet service. To keep pace with that reality, a region must establish a marketplace where innovation and competition can improve the quality of Internet services while also lowering their cost.

For heavily populated regions of the world including those in Canada, this marketplace is established almost entirely through consumer demand. This is because the demand for Internet services is so great that market forces can be allowed to operate almost freely. A serious challenge arises for less populated areas of the world. For communities, regions or countries that are relatively small, remote or isolated, the demand is insufficient to achieve similar results. As we have discussed in this report, failure to keep pace in the provision of quality Internet services threatens the competitiveness of these regions that in turn will affect their economic viability and long-term sustainability.

But how can these small markets compete with those that have almost perfect competition? The truth is they can't. But a lot can be accomplished in closing the gap through a very competition-oriented and proactive regulatory regime and an aggressive subsidization program. First, regulations are needed to ensure that Internet services exist for all the reasons discussed earlier in Sections 8.2 and 8.3, and to ensure the market operates as efficiently as possible. But second, public investment is a requirement. There is simply no manner under which a small, remote, isolated market can compete in an industry characterized by constantly increasing product quality at an ever decreasing price. Markets in the south achieve this seemingly opposite dynamic through massive investments in innovation, new technologies and costly infrastructure that are made affordable by market demand that is insatiable. Even under a scenario of perfect competition, these conditions will never exist in the smaller markets.

In this chapter, the market challenge for communication infrastructure, broadband and Internet services in Canada's territories is presented. The chapter is organized into four sections, discussing the nature of competition, innovation, regulation and subsidization.

"We can't get economies of scale here. Our entire population has this problem. Having a better understanding of mutual challenges is a good idea, but the issue won't be resolved unless we can address the underlying barriers to reducing costs and increasing services such as public investment as a critical infrastructure and regulatory issues that are preventing competition.." --- Rick Wind, Environment and Natural Resources, Government of the NWT

Competition for broadband

Dynamic and efficient markets contribute to economic growth, innovation, technical development and increased access to services. Markets that function well favour both businesses and consumers as they result in diversity of supply and put pressure on prices. The most important way of achieving efficient markets is functioning competition between the market players (Government of Sweden, 2010, page 18).

Government efforts to stimulate competition

The public sector plays a significant role in the broadband market in Sweden, acting as owners of broadband infrastructure, users of IT and broadband services, and as authorities responsible for regional and local planning and development. The central government there is a large owner of broadband networks, and a significant player in the market. They are directed to act as neutrally as possible to encourage competition, primarily selling unrefined wholesale services such as duct and dark fiber—what we commonly refer to as the Internet backbone in a fiber environment. Government owned broadband networks must aim to contribute to greater competition, to ultimately benefit households and businesses through more and better services and lower prices (Government of Sweden, 2010, page 25).

In Sweden, people believe the principal role of central government is to make the market work efficiently and provide the market players with good conditions in which to operate. Government must take the responsibility for ensuring broadband is available in the remote areas of the country that have poorly functioning markets with too few buyers and sellers of goods and services that would otherwise create competition. They work to identify constructive solutions that contribute to increased collaboration and deployment of infrastructure in areas where there is little prospect of expanding parallel infrastructure to compete on a competitive basis.

Australia has approached the challenge of providing services in its remote regions by first defining broadband levels that every Australian has the right to receive. They define 'genuine broadband' as "Internet access and use that is fast—at least 12 Mb/s with an upgrade path to go faster over time, accessible—always on, affordable, and in widespread use." (National Broadband Network, 2010a, page 2).

The Australian government believes that while investment to build an infrastructure that delivers 'genuine broadband' is high, it is not nearly as high as the 'hidden' costs of maintaining an imperfect market structure and insufficient competition in the provision of broadband services. Australians have calculated that over a period of 20 years, the economic cost of less competition and higher prices that reflect some degree of monopoly power could be 3-4 times more than the initial cost of providing the broadband facility in the first place. (National Broadband Network, 2010a, page 1). They compare competition in broadband services to competition in other types of infrastructure, such as electricity, water, gas, aviation and others that provide evidence (while not perfect) that

competition does ultimately result in sustained investment in the provision of services and sustained growth and employment.

The challenge in the Arctic is determining how to stimulate needed competition, and ensure this competition ultimately leads to more choice and better services for consumers from within government and for the general public.

Governments role in ensuring equitable access for all

Governments also play a pivotal role in ensuring equitable access for all. Most governments have taken a proactive approach to stimulating network roll-out in rural and other underserved areas. A World Bank report examining the role of governments in broadband explains that traditionally, underserved areas were served through internal cross-subsidization by the state-owned monopoly operator. Once markets were liberalized, this was no longer an option. Most underserved areas were then replaced by explicit subsidy mechanisms (infoDev, page 8).

The argument in this World Bank report is that because public and private services are increasingly provided online, the inability for some parts of the population to get access to broadband becomes more of a public policy problem. Data shows that when broadband usage reaches a critical mass in a country (e.g., 25 per cent) it will come to be considered indispensable for everyone if balanced development is to be achieved, without discrimination based on geographical location (infoDev, page 9).

Regulatory requirements

Government's role as regulator is complex as they must understand the interplay between competition, innovation and subsidies in meeting minimum standards. We have identified three issues regulators must grapple with for setting the environment in which operators must function in order to deliver needed services at an affordable price:

1. Regulators should establish a minimum level of service, including definitions of "affordability" in the context of the marketplace;
2. Regulations should allow for the possibility for innovation and therefore should not specify technology but only the level of service required (technology neutral);
3. Regulators must hold a deep understanding of the marketplace. If there is to be open competition for the few profit centres in the North, how does that affect competition and subsidization of small and isolated markets? What impact does competition have on existing network viability? What impact does no competition have on pricing and innovation?

Other countries have broadband implementation plans that include various strategies used by regulators and governments, with the intent of stimulating competition, innovation and investment wherever possible, including:

- Regulators set a minimum level of service to be delivered to all communities, regardless of geographic location;
- Regulators do not direct the market or technical development;
- Regulators' task is to create good conditions for the market, formulate policy targets and clear away obstacles to development;
- The goal is for universal service to be provided by the market at an affordable price. Government should only become involved when it is apparent that the market has failed -- with intervention based on sound economic principles and where the benefits of such intervention outweigh the costs;
- To support the investments it is important to have regulations that are long-term and predictable and that give market players an incentive to invest;
- In the event of market failure, government may request a service provider to provide service, but if cost represents an unfair burden, the government may take more direct position in that market;
- Regional market differences may call for unique solutions. For example some regions may be able to compete with more than one backbone provider, while other regions are only able to compete on the last mile—in this case regulators play a role in ensuring equitable access to backbone interconnectivity that stimulates competition;
- Regulations should promote backbone infrastructure competition wherever possible, with deployment of parallel infrastructure. Where parallel infrastructure is not possible, access by other companies to the dominant infrastructure should take place at as unrefined level as possible. "Unrefined wholesale services impose clear demands on the operators to make their own investments, while control of their own supply of services is greater, making it possible to differentiate the services with regard to content, quality and price. In addition, access at an unrefined level means that the intervention signified by regulation in relation to the dominant company does not become unnecessarily great." (Government Sweden, 2010);
- Where economic conditions for infrastructure competition do not exist, regulation can promote competition within an infrastructure and at higher levels of refinement.

The decisive factor is whether the regulations promote investments in new infrastructure and at the same time ensure effective competition. It is also important to factor in regional market conditions. There may be justification for competition within a backbone infrastructure in some regions while competition elsewhere may only take place at the last mile.

How will competition and incentives for new infrastructure investment be balanced? It can be argued that investment interest will be lower if market access was too easy or access to the backbone infrastructure too cheap. This applies in particular to infrastructure in remote areas where the rate of return is lower than in urban areas. But

liberalization of the market and greater competition has been a crucial factor in driving down costs and promoting innovation. The CRTC will need to understand these points when looking specifically at the Arctic marketplace.

It is a delicate balancing act. If new entrants to the Northern marketplace are not required to invest any of their own money, this does not drive innovation. At the same time, if there is not a great enough rate of return, the companies will eventually stop serving the Arctic, or at least uneconomic parts of it (which is essentially all communities except Yellowknife and Whitehorse).

Territorial and federal government departments concerned with issues of accessibility and affordability for the public have a strong role to play in the regulatory debate. Any group concerned with the long term survival of robust communication companies must also be engaged, including the service providers themselves.

Subsidization/government investment

The challenge of cross-subsidization

One of the challenges of subsidization in rural and remote Canada is the persistent use of cross-subsidy in building and maintaining infrastructure. While reliance on the 'cross-subsidy' model is no longer applicable in much of the world with the introduction of deregulation and liberalization of markets, we are still dependant on explicit and hidden cross-subsidization in the north.

For example, NWTel is expected to use phone service revenue from the larger markets to 'cross-subsidize' the cost of serving smaller markets, which in a northern context, means that the relatively small markets in Yellowknife and Whitehorse are to cross-subsidize over 90 other communities in the NWTel service area—this in itself is rather complicated. But as competition is introduced into these markets, will NWTel be able to continue providing services to unprofitable markets? Should competition be introduced in larger markets at the expense of smaller ones? Under this scenario, NWTel would have no choice but to argue against competition.

In an example of hidden cross-subsidy across services, NWTel competes to win government data service business. This investment is then used to cross subsidize smaller communities phone service access. Competition for the data service could threaten phone services in small communities which is considered part of the telco's "Basic Obligation to Serve".

While it makes sense from a superficial viewpoint to expect a company to internally cross subsidize its services across communities and business divisions, the unintended consequence is that when competition is introduced in a few areas, it threatens the entire communications infrastructure.

Competition for subsidies

In the Arctic, in recent telecommunications development, we have invited service providers to compete for subsidies in order to build new infrastructure that will support services such as broadband networks, cellular services and mobile radio services. (See Section 5.4 for a list of these initiatives.) Then, once the service provider receives the subsidy, they own the infrastructure they build. For each project, there are differing expectations from government investors for service provider investment.

In this 'competition for subsidy' model, it is expected that after competing for, and winning the subsidy for the initial investment, service providers will be able to deliver services at a profit that will allow them to maintain and upgrade their infrastructure through sales to consumers that keeps pace with technological change.

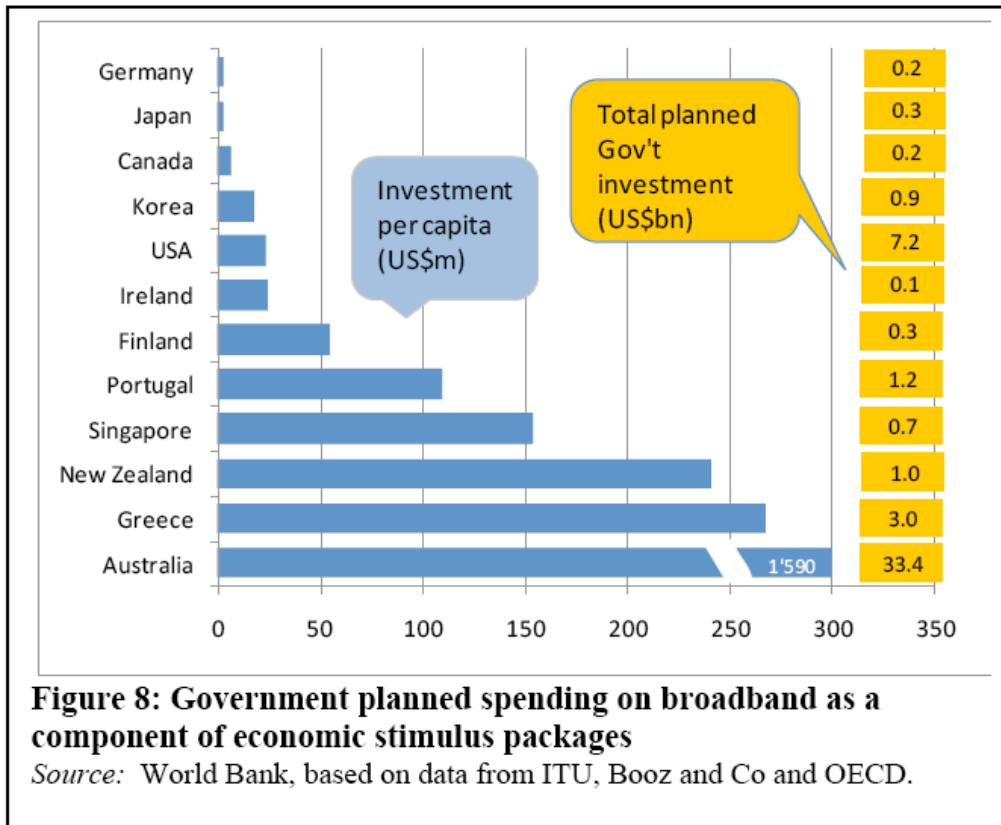
It is evident that this model faces challenges. If the model was working as envisioned, initial subsidies by government combined with private sector investment in 2003 and 2004 would have seen new broadband networks across the North expand and evolve to manage the introduction of services like YouTube, iPhones, Skype with video, movement of large files such as GIS mapping data, and full length movie distribution via the infrastructures with no additional government investment. It is simply not a realistic expectation in the Arctic environment with the high cost of providing service combined with the rapid escalation of use and expectation of increasing capacity from our networks.

Subsidization strategy

A 2009 report entitled "What Role Should Governments Play in Broadband Development" by the World Bank, a wide range of initiatives for providing broadband services was investigated. An important observation was that countries with coherent national strategies have tended to be more successful in fostering broadband diffusion. (InfoDev, 2009, page 5).

With national strategies, government makes investment commitments to build infrastructure, focusing on markets that have failed to produce the necessary services through competition. Depending on the market models used in each country, infrastructure procured by government may be owned by the government or industry, or a combination of both. In Sweden, for example, government owns a great deal of dark fiber, but there is competition built into its system wherever possible.

This chart below contains the relative investment into broadband networks from a number of countries, identifying planned government investment (InfoDev, 2009). While figures of different subsidy amounts vary depending on the publication and the inputs measured, the relative ranking of countries is the important data to note.



For a country like Australia, for example, with some similar geographic challenges as Canada, the government investment (\$33 billion out of 43 billion total investment) is based on a strategy of equal access for all, believing that broadband networks are the key to a robust economy that can attract international business and prosperity for residents.

There is no comprehensive strategy in Canada yet, and no strategy in relation to the Arctic.

The subsidy model used across the territories is difficult to understand. It does not appear to follow a clear strategy. And the results are a rather disorganized market with multiple service challenges. In Yukon, they are faced with one monopoly provider, which causes challenges for innovation and pricing. In NWT, they have two providers, with government investment for its core services provided by the incumbent Telco. In Nunavut, they have selected a new entrant for core government services, and the existing Telco has told the CRTC that its services in satellite-served communities are threatened.

To-date, the Government of Nunavut, clearly the 'anchor tenant' for any network in this high cost region, has chosen to move its services to this competing

network [SSi Micro], resulting in significant revenue losses that Northwestel relied upon to sustain the provision of services to remote high cost communities. Moreover, due to the high fixed cost nature of provisioning local access services to very small remote communities, a net impact will be to increase residential access costs on a per NAS basis. This extensive government funding not only created a very uneven playing field, it has now put at risk the sustainability of providing basic telecommunications services to these high cost satellite communities (NWTel, 2010, page 12).

Whatever subsidy models are determined to be best for the Arctic, it is clear that a one-time investment will not provide the necessary long term stability in the provision of broadband and other communication services, as technology and expectations of service continue to evolve. In most of our Arctic communities, there are requirements for ongoing subsidy for electricity provision, the building and maintenance of physical roads, and other major infrastructure. Communications infrastructure should not be treated differently—except that the pace of change is much faster. Any investment strategy must include provision for current (and increased) rate of change and continuous introduction of new consumer services and devices in the communications industry.

When all levels of government can work to develop a national and northern strategy for improving communications infrastructure, as most OECD countries have done, the question of how to subsidize networks must be front and centre in the debate.

Innovation

Innovation can be viewed in the traditional sense with respect to technological innovation, but also refers to innovation in the manner in which the market operates.

Technological Innovation

Innovation is the development and implementation of new concepts, products or services unique to the target market. Technological innovation involves research and development (R & D), and as such, these projects are often eligible for tax credits.

Innovation is something to be hoped for but cannot be mandated, and it is rare.

In an Arctic environment, the small size of the target market means that technological innovation is unlikely without significant investment to entice providers to innovate, as they must eventually obtain a return on investment, and the market is simply too small.

There is certainly some innovation in the Canadian Arctic in communications. Yukon College researchers are doing cold climate innovation, experimenting with green power to repeater stations that may reduce operating costs of microwave backhaul sites. The military is experimenting with rapid response cell phone service that can be delivered via a balloon over a temporary site. Communications Research Centre experiments with improving satellite communications, leading to innovative changes over the years. Cisco's

Internet Routers in Space program is another example of innovation - a program that has the potential to profoundly improve satellite latency for users all over the world.

There is no shortage of innovative solutions to be found for the north. From improvements to satellite services to meet increasing bandwidth demands to the greening of repeater stations, to the development of custom software that support Inuktitut that can be managed through a tablet in the field. The list of innovative services that the North could use is endless.

For the service providers in the Arctic to truly innovate, they will need access to much larger markets who need their innovative products to provide a return on investment. Or, they will need government support to innovate.

Marketplace innovation

There are many reasons broadband markets fail. These include:

- the persistence of monopoly-type structures in the provision of broadband infrastructure, even when no legal monopoly exists;
- lack of economies of scale;
- Difficulties in obtaining legal permission to operate;
- inefficient allocation of radiospectrum; and,
- poor information and limited capital markets (infoDev, 2009, page 6).

Normally, these market failures in the ICT sector are addressed through regulatory policy, such as:

- liberalizing licensing regimes;
- facilitating efficient access to radiospectrum and regulating access to dominant operators' networks;
- provide regulated access to the incumbent operator's network ("unbundling the local loop"); or,
- providing low-cost access to existing infrastructure facilities such as energy and transport networks (infoDev, 2009, page 6).

Some examples of 'innovation in addressing market failure' have been undertaken in various countries.

In France, they have implemented a "ladder of investment" approach:

"At the lowest level is resale of the incumbent's capacity, which requires interconnection at only one point in a network.

Later, bitstream access was offered at a regional level, whereby the entrant would interconnect at multiple regional points and construct a backbone network between them.

As full unbundling of the local loop was mandated, full-service operators, such as Iliad (www.free.fr), have further generated growth in direct competition to the incumbent, France Télécom, while building their own networks. (infoDev, 2009, page 5)

The Republic of Korea provides positive financial incentives for operators to invest and compete in a "public/private partnership". The government provides "administrative guidance" to the private sector, and works via public/private institutions to foster national targets and goals (infoDev, 2009, page 8).

8.6 Conclusions on the Economics of Broadband

There isn't a single approach to bringing a great broadband service to a region. In our study of the world leaders in broadband, each has taken a different path. In Sweden, the government has approached the challenge from a view of market demand, but with the caveat that equality is an important value within Swedish society. The first question for that country was "what services do/will the citizens of Sweden want?" Followed by, "how can these services be delivered to rural and remote locations?" Their response has been a mix of regulations on private sector users, public investment, and ownership. Where the market cannot be competitive, Sweden is investing in the backbone and allowing competition for the last mile.

Australia is taking a very different approach. There, the government regards the challenge from the perspective of supply. It has established a minimum standard of service that all Australians must have access to; 12 Mb/s. In setting this standard, it has determined the market would be incapable or too slow in achieving this standard. Its answer is to establish the National Broadband Network, which will invest \$43 billion over eight years in a mix of fiber optic cable and satellite infrastructure for the entire country. The competitive market will still exist, but will have equal access to this government backbone.

In the United States, where political ideology tends to favour the free market more so than most other countries around the world, the government is also taking a very active and aggressive role in bringing broadband to its remote communities. The government will not build the infrastructure itself, but will provide large subsidies to ensure broadband services are accessible to all Americans. This includes an \$8 billion communications strategy of which \$4.3 billion will go into the least populated north western states including North and South Dakota, Wyoming, and Montana.

There are many other examples. The French market for broadband was dominated by the country's national telecommunications company. This is changing by gradually giving the new private sector access to the national backbone. In Korea, the approach to broadband development has been one of private and public partnerships with very high and stringent regulatory standards.

What does this all mean for Canada's north? Countries around the world have been successful by first recognizing the market conditions that exist. One would not automatically think of Australia as the country most likely to have its government hold such a large position in a market that it acknowledges as being highly dependent on competition. But it has done this because it sees the laws of competition also apply internationally. If Australia is to be competitive in the 21st century, it must have this infrastructure in place now. Similarly, one might expect a country like Sweden to view the broadband market from the position of a public good and follow a socialist approach in investing and owning. In their case, the Swedes have determined the role of competition is important in reducing costs and increasing innovation. Where that competition is challenged, the government will invest in and sometimes own the backbone, but otherwise not interfere with the competitive process.

The recent report issued by the Federation of Canadian Municipalities in response to the federal government's Northern Strategy sets out an important recommendation for the future of the North - to benefit both residents and Canada as a whole:

"It is always assumed that major infrastructure investments begin with huge ticket items, like roads and railways. Led or supported by the Canadian Forces and local municipalities, the Government of Canada should begin instead by building a world-leading information technology infrastructure for remote regions, focusing in particular on service access and bandwidth improvement. Doing this with Canadian business could help produce a global business opportunity. Creating a next generation information technology network to provide a wide range of services – e-government, e-entertainment/ e-culture, e-health, e-education, remote work, etc. – will improve the quality of life in the North, and connect the region to the country and the world very effectively. The effective provision of IT services across the North should become a hallmark of Canada's 21st century commitment to the country's remote citizens, as well as any military stationed there" (FCM, 2010).

These are important concepts. In order to meet this important recommendation, we provide some economic recommendations to consider.

Economic recommendations: proposed steps for a way forward

Step 1. Understand the market.

First and foremost, it is imperative that the key stakeholders *understand the market*. Canada's territories share some similarities with Sweden's remote communities and Australia's outback, but there are still many characteristics unique to this marketplace. Any future changes to the industry must be made with full recognition of the unique characteristics that exist in that market.

Step 2. Recognize the importance of competition.

There is probably no other industry where it is so vital in lowering price, adding innovation, and improving what has essentially become a public good. Accepting the role of competition does not translate into a singular, hands-off approach to regulations. We have found that even in the United States, this is not the case. Where vertical or complete competition cannot be achieved (from the infrastructure right to the home), then competition can be made possible at different market segments. For example, competition at the research and development stage, competition for the installation of infrastructure, and/or competition at the community level for household consumers.

Step 3. Establish standards.

There are many strong arguments why fast, reliable, and secure broadband services are needed in the three territories, and not a single strong argument why they are not. It must be understood that as technical standards evolve, minimum standards must evolve as well. There have been numerous studies that indicate the effect broadband investments have on GDP and government costs over the long run. A study of this nature is needed in the three territories. Within that process, regulators must determine what minimum speeds are going to be. It is only after that has been established that regulators can begin to assess the best approach to bringing these services to the market.

Step 4. Develop and articulate a communication infrastructure and broadband strategy that will achieve the minimum standards.

This will include a large public investment. But how that investment is made will be based on Canadian values and ideology. The success of countries like Sweden, Australia, the United States, France, and Korea in becoming world leaders in broadband is largely a result of understanding their own market place, taking a clear position on how the market will evolve, and then following that position closely. Currently, there is no clear strategy or approach across the three territories.

Step 5. Stop relying on cross-subsidization models.

The Canadian telecommunications industry has long relied on cross-subsidization to bring essential services to all citizens. This will no longer work for modern communications infrastructure in the north. There is some competition possibilities in the two largest markets (Whitehorse and Yellowknife), but even there, the population base is not enough to support a lot of innovation on its own. And certainly, there is no room for these markets to subsidize others across the North. It might be more appropriate to think of the current system where Yellowknife and Whitehorse subsidies are supporting deficiencies in the subsidies for remote communities.

Step 6. End market disruption caused by government's muddled approach to the marketplace as owners, regulators, and purchasers of broadband services.

In most governments, the role of regulator and the role of purchaser fall to two separate departments who are not required to meet the other's mandate. It is not reasonable to expect the customer/commercial part of the government (the buyer) to meet the 'consumer right to affordable access' task set out by the economic development department. In another example of complicated mixing of roles, if the same government department that purchases service from the private sector in competitive tendering also owns significant parts of the infrastructure, this will add another level of complexity. For every hidden cross-subsidy, or implementation of mixed models, there are consequences to the market. Once rules are established, government must follow its own rules and regulations and take a transparent approach to its current and long-term purchase requirements. Unraveling this problem starts back at steps one and two and understanding the market and designing a strategy that fully recognizes the market realities.