GSR discussion paper

Monitoring the Implementation of Broadband Plans and Strategies

Work in progress, for discussion purposes

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Table of Contents

Monitoring the Implementation of Broadband Plans and Strategies

Author: Mr Colin Oliver

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Executive summary

Measurable information about the supply and use of broadband provides a basis for judging whether broadband plans and digital strategies are achieving the objectives that have been set.

While strong and effective national plans will reflect local circumstances and priorities, there are many common elements to be considered. Indeed, one of the marks of an effective performance-monitoring regime is the extent to which the key performance indicators adopted allow international comparisons to be made.

This paper therefore includes a brief review of the principles of performance monitoring and looks at the increasingly broad scope of broadband plans before moving on to examine how the implementation of broadband plans and strategies can be monitored.

The argument of the paper is that monitoring needs to be a fully integrated part of broadband plans and strategies – providing an information base for the initial development of plans and strategies as well as for checking the progress of particular policies and programs, and for the evaluation and reassessment of priorities and strategies. Within practical limits, monitoring should provide information on all aspects of the broadband market/ecosystem. The scope of many national broadband plans is already very wide, raising questions about coordination, information sharing and the role of the regulator.

This paper reviews the issues around the monitoring of broadband plans as attention moves from:

- initial *deployment* to make broadband available;
- through projects and programs to encourage the *adoption* and take-up of broadband,
- to *integration* of broadband as a core element in the digital economy.

As that process of development occurs, performance monitoring helps to ensure that targets, costs, benefits and outcomes of projects are measured and programs are well managed.

In the deployment stage, there is a focus of attention on basic telecommunications/broadband indicators of availability obtained from service providers. When attention moves to indicators of adoption and use, barriers to access such as the need for improved digital literacy may need to be identified and overcome by means of projects and programs that will require monitoring and assessment of costs and benefits. Some regulators have adopted innovative ways to expand and apply this information:

- some provide greater detail and depth of information, even down to the local community level;
- some publish this information online to assist both users and suppliers in decision-making;
- some engage in regular reviews of progress, focussing particular attention on the identification of barriers and ways to overcome them.

When high-speed broadband becomes a core element of advanced services in sectors such as health and education, the savings flowing from the use of broadband-based connectivity may outweigh the costs. Within each sector, short, medium and long-term agendas need to take account of the different challenges associated with the deployment, adoption and integration stages, weighing short-term costs against long-term gains. When broadband is fully integrated in these sectors, attention turns to outcomes measured not only in terms of costs and savings, but also in terms of overall gains in capability, efficiency, productivity, innovation and public welfare. New measures may need to be developed to monitor changes in people's behaviour and increased dependence on broadband-based services.

1 Introduction

A recent study shows that countries with a national broadband plan[1] have a better track record for expanding both fixed and mobile broadband penetration compared with countries that do not have a plan. With all other variables held constant, countries with a plan have a 2.5% higher fixed and 7.4 % higher mobile broadband penetration. The study also found that without a competitive market broadband penetration is lower: 1.4% lower for fixed and 26.5% lower for mobile broadband access.[2] A competitive market is a key engine of growth in many broadband plans.

Measurable information about the supply and use of broadband provides a basis for judging whether broadband plans and digital strategies are achieving the objectives that have been set.

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The argument of the paper is that monitoring needs to be a fully integrated part of broadband plans and strategies – providing an information base for the initial development of plans and strategies as well as for checking the progress of particular policies and programs, and for the evaluation and reassessment of priorities and strategies. Within practical limits, monitoring should provide information on all aspects of the broadband market/ecosystem. The scope of many national broadband plans is already very wide, raising questions about coordination, information sharing and the role of the regulator.[3]

This paper reviews the issues around the monitoring of broadband plans as attention moves from:

- initial *deployment* to make broadband available;
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As that process of development occurs, performance monitoring helps to ensure that targets, costs, benefits and outcomes of projects are measured and programs are well managed. This paper therefore reviews issues connected with monitoring the implementation of national broadband plans with examples of good practices.

Performance monitoring - a brief primer

The overall vision for a broadband-enabled society and economy may be supported by a number of strategies to develop broadband infrastructure and to build human capacity. Common objectives are to extend networks to unserved areas, expand competition, improve the pricing and affordability of services, build capacity and improve digital literacy to support the overall adoption and use of broadband services. Each of these objectives may be resolved into a number of projects. Performance indicators will be

[1] In this paper "*broadband plan*" is used as shorthand to include broadband policies and strategies and digital agendas, while recognizing that each country's choice of language will reflect its own priorities.

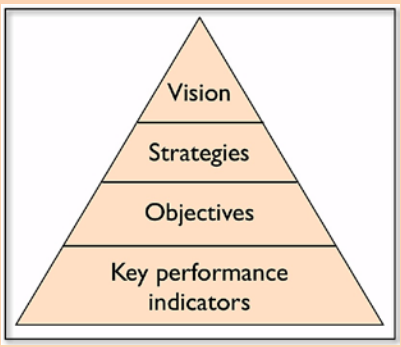
[2] ITU Planning for Progress: Why National Broadband Plans Matter 2013

[3] "Regulator" refers to ICT/telecommunications regulators, recognizing that in some cases regulatory and policy roles in broadband plans may be divided between separate agencies.

required to measure progress against starting points, completion of key component elements and the ultimate achievement of targets and objectives.

Performance monitoring is usually conceived as part of an overall strategic planning framework, often set out in a simple pyramid structure as in figure 1.

Figure 1: Performance monitoring as part of a result-based management framework



Source: author

In a private sector result-based management framework, commercial strategies and objectives can often be translated into key performance indicators and targets for individual teams and staff members. In the public sector it is notoriously more difficult to achieve such clarity of vision. In public affairs there may be a number of competing objectives and strategies, supported by multiple institutional interests, resulting in a lack of "ownership" of the overall project and a focus on process rather than outcomes. At the international level, the Broadband Commission has therefore devoted much effort to building awareness of the importance of broadband at the highest political levels.

Status of broadband indicators and performance indicators

Policy makers and regulators need to ensure that objectives are being achieved. They need reliable, relevant and structured feedback to help them decide whether program adjustments are needed.

The standard broadband indicators have been usefully divided into categories of availability, demand quality and affordability, as shown in figure 2. They are discussed in detail in the World Bank *Broadband Strategies Toolkit*, section 2.4.

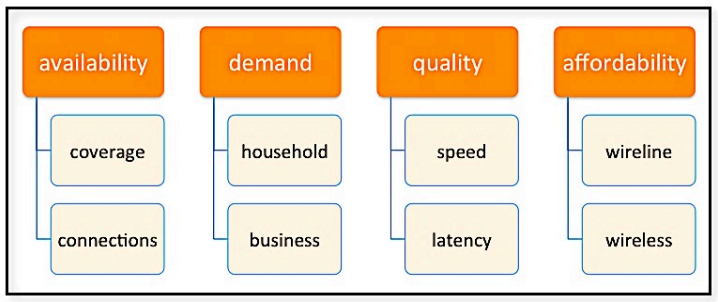
Policy makers and regulators can learn from comparisons with developments in similar countries. Well-established good practice is that national data collection should be based on internationally–agreed standards and definitions, such as those developed by ITU and the Partnership on Measuring ICT for Development.[4] The ITU/BDT World Telecommunication/ICT Indicators Symposium (WTIS)[5] is an important forum in which ITU members work together to keep telecommunications and ICT indicators up-to-date in an environment of rapid change.[6]

[4] http://www.itu.int/en/ITU-D/Statistics/Pages/intlcoop/partnership/default.aspx

[5] http://www.itu.int/en/ITU-D/Statistics/Pages/events/wtis2013/default.aspx

[6] The ITU website holds the current List of the indicators included in the World Telecommunication Indicators/ICT Indicators database, December 2013, of which 26 relate to broadband. The ITU Handbook for the Collection of Administrative Data on Telecommunications/ICT (2011) is a key reference document for the collection of internationally comparable indicators on telecommunications/ICT based on administrative sources (*i.e.* supply-side data mainly from operators). The Handbook includes definitions and methodological clarifications for 81 internationally agreed indicators and corresponding sub-indicators, discussed by the Expert Group on Telecommunication/ICT Indicators (EGTI). The Handbook was released at the

Figure 2: Categories of broadband indicators



Source: adapted from Telecommunications Management Group & World Bank Broadband Strategies Toolkit, Section 2.4

The most useful indicators may also be expressed as targets. Measureable targets focussed on high priority needs and objectives enable progress to be assessed objectively. Given the pace of change in the broadband environment, it is widely agreed that targets should look ahead three to five years and that they should be reviewed regularly to remain both ambitious and realistic. This does not exclude a longer-term vision. Egypt is an example where targets are set in terms of availability, penetration and community access expressed as both short and long-term targets (2015 and 2021) for both fixed and mobile services.[7]

There are different kinds of indicators. As well as the standard telecommunications and broadband indicators other key performance indicators (KPIs)[8] can be used to monitor progress, identify problems, measure costs and benefits and facilitate decisions on any re-direction that may be required in the broadband plan.

- *Quantitative* indicators are presented as a number: examples being customer numbers, traffic volumes, investment totals, and average repair times.
- *Qualitative* indicators may not be expressed as a number but they may be expressed as positive or negative, complete or incomplete, high or low: examples are measures of customer satisfaction, industry competitiveness, ICT readiness, skill levels, program implementation (and in some cases formulas and coding of qualitative information may be applied to express these also as numbers).

Not all indicators are equally useful. Ideally, a broadband plan or strategy should incorporate a manageable number of indicators that:

- relate to high level goals,
- are practical to collect,
- are consistent across countries as far as possible, and
- reveal the extent of progress toward the achievement of measurable targets.

Telecommunications indicators provide well-established measures of "deployment" or "availability" of services (for coverage, connections *etc*.,) but measures of "adoption and effective use" are still being developed. The OECD proposes to include in future work more detailed measures of the adoption and use of the internet by households and businesses, paying more attention to the intensity of use, and

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9th ITU World Telecommunication/ICT Indicators Meeting, in December 2011. The OECD Communications Outlook 2013 Chapter 4 on network dimensions and development also discusses the widening scope of broadband indicators

[7] eMISR National Broadband Plan, Egypt 2011, Executive Summary, page 10

[8] Sometimes also called "key success indicators"

exploring concepts of *technology engagement* and *technology dependency*.[9] The notion of "dependency" aligns closely with the Japanese concept of "indispensability" when applied to online services – a condition where access to the broadband Internet becomes fully integrated into people's lives in a way that makes connectivity a necessity for social and economic life. Such measures usually rely on contracted research and surveys rather than statistical reports from operators and include broader considerations such as the utility of ICTs in achieving social and economic goals.

This paper reflects the spirit of this work in connection with the monitoring of broadband plans as attention moves from:

- initial *deployment* to make broadband available;
- through projects and programs to encourage the *adoption,* take-up and efficient use of broadband,
- to *integration* of broadband as a core element in the digital economy.

2 Coordination and oversight: the monitoring framework

Every country with a broadband plan has its own unique set of social and economic conditions, and its own particular baseline for the development of broadband infrastructure.

Table 1: Overview of key areas in a monitoring framework

Area	Responsibility	Key areas	Information sources
Strategy development: Making good policy choices.	Policy & coordinating agencies with the regulator	**Local circumstances** National priorities State of the market – demand & supply Business case for investment Human capacity	Broad consultation Industry, regulator Economic, financial & social statistics International experience & data
Program management: Tracking progress of projects and programs toward goals & targets.	Regulator & implementing agencies	**Performance Indicators** Costs & benefits Project/program results for broadband access, improvements in capability and efficiency	Regulator Market players Business users Program participants Community leaders
Policy Evaluation: Monitoring development of broadband access infrastructure, prices, affordability and usage.	Regulator, coordinating agencies, & national statistical offices	**Outcomes** Penetration & access Investment, competition & market effectiveness Adoption and effective use Innovation Economic impacts	Regulator Statistical agencies Industry reports Social agencies (education, health *etc.*)

Source: Author, adapted from Broadband Commission The State of Broadband 2013 (Sept 2013) p 78-84

Logically, the work of monitoring broadband development begins with the initial survey of relevant conditions and priorities, considering overall national priorities, the economic and social environment, the unique geographical and other circumstances of the country, and the level of broadband awareness among key stakeholders, government agencies, business and community leaders and the public at large. The Broadband Commission has recommended that priority be given to supporting accurate and timely statistical monitoring because reliable data and indicators are essential for three broad purposes:

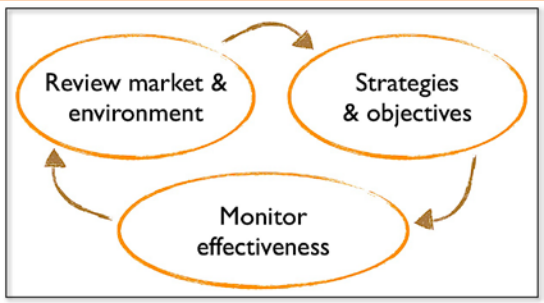
1. Making informed policy choices.

[9] *The Internet Economy on the Rise: Progress since the Seoul Declaration*, OECD, 2013, pages 75-78

2. Assessing the impact of broadband policies and tracking progress toward goals and targets.
3. Monitoring development of broadband infrastructure, access, prices, affordability and usage by individuals, businesses, governments, schools and hospitals.[10]

The structure and approach adopted in this paper largely mirrors these three purposes as illustrated in Table 1 The focus will be on monitoring program management, tracking progress toward goals and targets, and the evaluation of outcomes as the strategy development stage should be already in place. Of course all the information sources that are important at the strategy development stage, including broad consultation, continue to be vitally important as the plan is implemented.

Figure 3: Cycle of policy implementation and improvement



Source: Author

As figure 3 indicates, monitoring should be an integral part of broadband plans in order to provide feedback on implementation and ultimately to support the evaluation of progress and refinement of strategies and objectives. Measurement and management go together: managers need accurate and up-to-date information to enable them to manage their programs effectively, so strategies should be framed with implementation and monitoring in mind.

From broadband development to broadband integration

Table 2 shows how the balance of attention shifts from established telecommunications indicators and measures of availability of service through to outcome measures as broadband becomes more integrated into the wider economy and society. As implementation moves from one phase to the next, much of the work may be embodied in short and longer-term projects and programs to increase the number of users of broadband services and assist the transition to a broadband-enabled society.

In the first phase, monitoring concentrates on broadband network *deployment* to make services available as widely as possible. Standard telecommunications indicators of coverage, capacity, technology take up and price are essential for measuring progress. Where public funding supports rollout programs, more detailed performance indicators will be required to ensure transparency and accountability.

[10] "Policy choices must be informed by reliable data and indicators on ICT developments. Statistical indicators are also essential to assess the impact of broadband policies and to track progress towards national and international broadband goals and targets (including the targets set by the Broadband Commission). Data collected at the national level should be based on internationally agreed standards and definitions, such as those developed by ITU and the Partnership on Measuring ICT for Development. Data should be collected on a timely basis to monitor broadband infrastructure and access, prices and affordability, and broadband usage by individuals, businesses and public organizations such as Governments, schools and hospitals." Broadband Commission The State of Broadband 2013 (Sept 2013) p 84

Table 2: A shifting balance: monitoring successive phases of a broadband plan

Broadband deployment — adoption — integration		
Broadband network availability >	**Broadband access & capacity building for effective use** >	**Broadband integration in economy and society**
Deployment >	**Adoption** >	**Integration**
Examples: optical fibre cable and wireless broadband access networks	*Examples*: digital literacy programs; community access projects and programs	*Examples*: e-health, e-governance, e-education and e-commerce strategies
Telecommunications indicators		
	Performance indicators	
		Outcome measures
Indicators and outcome measures monitor achievements against targets. Performance indicators track program results, costs, benefits and progress against "process milestones" (e.g., for regulations, agreements or contracts).		
Source: author		

The second phase, *adoption*, builds upon the first. Basic telecommunications indicators remain important, particularly those relating to the take up, price, variety and quality of services, and the area of focus expands to include subscription rates, resilience, and quality. Projects and programs promoting access and human capacity need to be monitored with performance indicators tailored to each project to ensure that targets and timelines are met. The costs and benefits of projects supporting both availability and adoption can at this stage be measured and larger social and economic outcomes begin to emerge including changes in consumer behaviour.[11]

A process of evolution opens up the third phase in which the focus is on monitoring and evaluating the social, economic and institutional utilisation of broadband as a fundamental underpinning of the wider use of information and communication technologies in sectors such as health, government, education, commerce, public information and the media. Telecommunications indicators of speed, quality and reliability become more important. Price indicators remain important; although proportionally the cost of broadband may be out-weighed by other ICT-related user costs. Indeed, performance indicators may show that cost savings flowing from *integration* of broadband in areas such as health can greatly outweigh the costs. And so attention turns to outcomes measured not only in terms of costs and savings, but also in terms of overall gains in efficiency, productivity, innovation and public welfare.

Obviously, the three phases are not rigidly separated. ITU broadband data[12] shows that most broadband plans contain elements from at least two and sometimes all three phases (see figure 4). This is appropriate because the demand "pull" is just as important as the supply-side "push" for broadband development and use. For example, rural access projects to expand network reach in developing countries are generally conducted in tandem with programs to build human capacity. Similarly, "digital economy" agendas in countries that emphasise high speed access and applications will continue to feature programs to expand availability and adoption of services in regions that lag behind the main urban and business centres.

[11] The challenges of assessing costs, benefits and economic impacts *ex ante* are discussed by Dr. Raúl L. Katz, *Monitoring the Implementation of Broadband Plans*, ITU/BDT Regional Economic and Financial Forum of Telecommunications/ICTs for Latin America and the Caribbean, San Jose, Cost Rica, March 11-12 2014. Dr Katz comments "considering the amount of investment in ICT, and their economic impact, the amount of data and analysis leading to decisions is typically sub-optimal."

[12] See ITU's ICT Eye portal on ICT data and regulatory information: http://www.itu.int/icteye

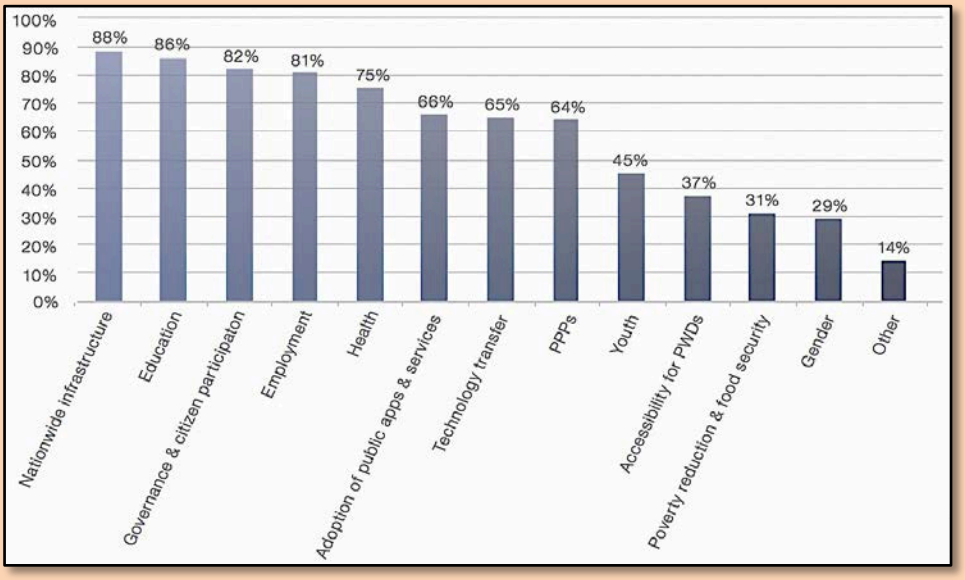
Coordination framework

There are many aspects of broadband plans that fall outside the jurisdiction of regulators, particularly in the areas of adoption and use of broadband and its integration into wider social and economic life, as illustrated in Figure 4. Since broadband and the Internet are multi-purpose technologies with a growing range of uses, it is important to have clearly identified:

- Who owns the plan?
- Who has the oversight and coordination role?
- Who is responsible for monitoring implementation and sharing information about progress?

Different agencies may have responsibility for inter-related aspects of a broadband plan such as market regulation, land access and civil works coordination, ICT use in government agencies, schools and medical centres. High-level government oversight is therefore necessary to provide a framework for cooperation and coordinated implementation of major projects.

Figure 4: Key elements of broadband plans



Source: ITU/UNESCO Broadband Commission for Digital Development, Planning for Progress: Why National Broadband Plans Matter 2013

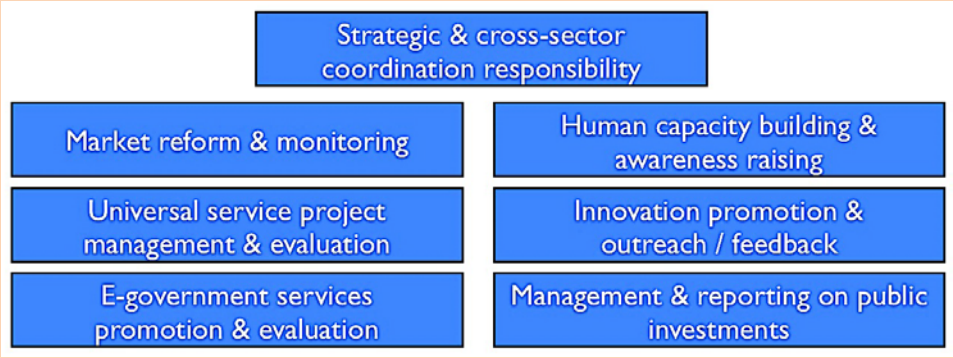
Clearly, where multiple agencies are responsible for different elements of the plan, an overall coordinating framework should be put in place to share information and coordinate initiatives for the supply and use of broadband. Some broadband plans assign the coordinating role to a particular ministry or agency. In Mauritius, for example, a National Broadband Task Force to coordinate the implementation of the National Broadband Policy is established by the Ministry for Information and Communications Technology.[13] In Poland, the Ministry of Administration and Digitization is responsible for the National Broadband Plan's overall implementation, monitoring and updating while other agencies such as the regulator and the economic ministry have important contributing roles.[14] In federal states, where regions or provinces have their own ICT agendas, the issue of centralised or decentralised coordination and monitoring needs to be considered pragmatically, in line with national practice.

[13] Republic of Mauritius National Broadband Policy 2012-2020

[14] Poland, Ministry of Administration and Digitization

Figure 5 offers a generic model of the allocation of roles and responsibilities for implementing and monitoring a broadband plan in which roles are allocated to relevant national agencies within an overall coordination framework.

Figure 5: Allocation of roles and responsibilities in implementation and monitoring of a broadband plan



Source: author

Such a framework will facilitate coordinated action on cross-sector activities and ensure maximum transparency of purpose and progress as the various elements of a broadband plan are implemented. It should also help to ensure that:

- market initiatives and other forms of innovation are encouraged and supported, with feedback to ensure that all stakeholders are fully informed of developments;
- responsibility for ICT education and human capacity building is allocated to the agencies best placed to support the requirements of both the industry and users;
- responsibility for promotion and public awareness activities is appropriately assigned and funded;
- information on complementary programs is shared and published; and
- regulatory matters are handled in such a way as to support the overall broadband agenda.

3 Measuring and managing the implementation of broadband plans

Regulators have a central role to play in monitoring the implementation of broadband plans. Even where responsibility is shared with other agencies, the regulator may play a number of key roles as

- the leading agency on telecommunications regulatory matters,
- the repository of industry statistics and publisher of key indicators, and
- a leading source of expert advice on technical, industry and consumer issues.

Depending on national arrangements, the regulator may also have an implementing or contributing role in areas including:

- spectrum allocation for wireless broadband services,
- administration of universal service funds,
- industry promotion and development,
- regulating competition and investment in the supply and use of broadband services,
- civil works coordination in support of broadband infrastructure, and
- ICT and media regulation more broadly.

While there may be differences in national arrangements, it is important that regulatory agencies play a lead role as independent providers of information about the development of the broadband environment, and the growth of broadband access and adoption. They also have a lead role to play as thought leaders and broadband champions since they will generally be the best-informed agency on broadband issues.

Much has been written about the need for an enabling environment to support broadband deployment. Where the key elements are not yet in place, it may be necessary to monitor their development through to completion so that all the essential building blocks will be in place.

Are key elements of an enabling framework in place? A checklist

Appendix A provides a checklist of items that may be included in a monitoring plan. The following discussion of elements of an enabling framework may or may not be relevant to a particular country, depending on the extent to which a broadband policy has been developed and implemented.

✓ Regulatory scope held

Broadband brings challenges including the convergence of previously separate communications services, and the regulator's mandate may need to be adjusted or expanded to deal with issues including convergence, competition, consumer issues and spectrum reform if it is to perform an enabling role in implementing broadband plans.

✓ Regulatory capacity enhanced

Similarly, the regulator will need staff with the skills and knowledge to carry out its role. Ongoing staff development and enlistment of expertise will be required to deal with the challenges of implementing broadband strategies and plans. The *Connecting Africa Report* 2013 reviewed connectivity, universal access policy, the regulatory framework, ICT skills and e-applications and found that broadband was the "single most critical element stimulating growth." It found that much had been achieved in terms of connecting major cities and towns, and that village-level mobile and wireless access had improved, but that skills development remained a broad concern, and that "capacity building in key economic and technical regulatory aspects such as licensing, universal access, frequency management, numbering, interconnection, data management, digital migration and cyber-security is essential." [15] Building and maintaining the skills and capacity of broadband policy and regulatory agencies will remain important in meeting the challenges ahead.

✓ Broadband plan in place

There remain some countries where no formal broadband plan or strategy is in place. In that case, the progress of policy development work, including consultation, information gathering and preparation of draft proposals, may need high-level consideration.[16]

✓ Spectrum reform for optimizing the provision of wireless broadband access

Spectrum reform and provision for wireless broadband access are pressing issues in many developing countries because wireless offers the fastest and cheapest service to remote, rural and highland areas and it offers the benefits of strong synergies between basic voice and broadband data-intensive services.

Spectrum access problems sometimes arise from cumbersome institutional arrangements that can only be overcome by institutional reforms. Otherwise, the allocation of spectrum for wireless broadband

[15] Connecting Africa: An Assessment of Progress Towards the Connect Africa Summit Goals, African Development Bank 2013, page 79

[16] In the European Union a satisfactory broadband plan is a precondition for the use of structural and cohesion funds from the European Union budget to support broadband upgrades.

access can be delayed.[17] Access to spectrum will be a vital element in the business plans of potential broadband wireless access networks. Investment in wireless broadband access therefore needs to be supported by a clear timetable for the provision of the necessary spectrum access, and by transparent monitoring of progress in clearing the relevant radio frequency spectrum where that is required.

✓ Simplified licensing to facilitate broadband service expanded

Rigidities in licensing arrangements can also hold back broadband development. For that reason, many regulatory authorities have been moving to simplifying licensing arrangements both to unify previously separate licences and to remove unnecessary technological restrictions. Unified and technology neutral licences give licence holders the ability to modernise and extend their services without unnecessary regulatory constraints or excessive fees. Introduction of a broadband plan can provide an opportunity to include licensing reforms in the overall implementation timetable.

✓ Telecommunications indicators systematically reported

Basic telecommunications indicators on the number of services offered, subscriber numbers and traffic volumes by technology and service type remain an essential tool for policy makers, regulators and industry in developing and monitoring their broadband business plans and policies.

✓ Civil works facilitated

A high proportion of the cost of network construction arises from civil works. To reduce costs, delays and inconvenience, major infrastructure rollouts require clear protocols to be in place with local governments and agencies responsible for roads, railways and energy supplies. This is an area in which process milestones are useful – not just achievement targets – since it involves cooperation with a number of stakeholders, identification of specific obstacles, development of collaborative processes and potentially changes to regulatory arrangements to protect the interests of both network builders and property owners. Some examples will be discussed in following sections.

✓ Infrastructure sharing facilitated

The high cost of civil works and passive infrastructure relative to the overall investment in broadband also means that infrastructure sharing should be facilitated in order to reduce the overall cost of investment. Barriers should not be placed in the way of commercial arrangements for infrastructure sharing and there will be cases where regulatory action is required to ensure that competitors have access to bottleneck facilities. Infrastructure sharing may also extend beyond telecommunications networks: there can be strong synergies with energy utilities, for example, both in extending access to rural and remote areas and also reducing network rollout costs in built-up areas. The European Commission estimate that new measures to reduce costs of deploying infrastructure (including sharing of passive infrastructure, transparency and coordination of civil works, streamlined permit granting procedures and more buildings ready for high speed network access) could reduce investment costs by 20-30%.[18]

There may also be scope for cooperation in sharing of backbone facilities. Competing operators often prefer to maintain independent backbone networks, but regulatory agencies may facilitate cooperation in sharing of passive facilities and the construction of shared backbones where that is the most cost-effective way of extending the reach of broadband networks into unserved areas.

[17] These issues are explained in detail in ITU Guidelines for preparation of national wireless broadband masterplans for the Asia Pacific region

[18] Filippo Munisteri, Broadband policy development and implementation in the EU, Presentation for ITU Asia Pacific Centre of Excellence Training, October 2013

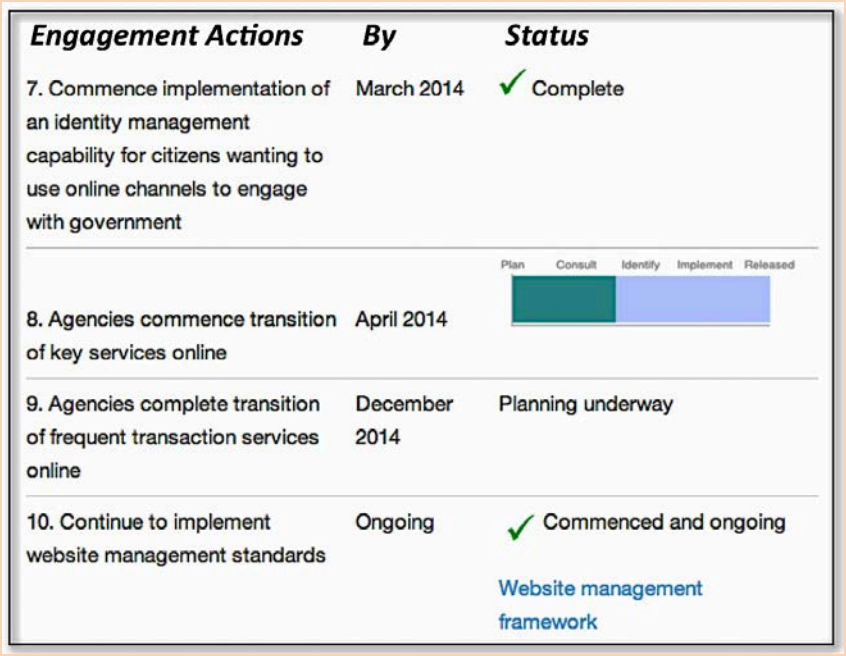
✓ Gateway access facilitated

International connectivity and gateway access is essential for broadband network operators. Regulatory agencies may need to take steps to facilitate open access arrangements on commercial terms, and, where necessary, to ensure diversity of access and protection of essential facilities.

* * *

The summary checklist in *Appendix A* includes measures that may require to be monitored in the implementation of a broadband plan. Not all the elements in this list are essential in every country, but the relevant elements should form part of the checklist of measures to be monitored for effective implementation of a broadband plan. Many of these elements can be monitored in a simple "traffic light" report, which can be maintained by the regulator or coordinating agency and published online, indicating the status of key actions and building blocks. Progress can be expressed in terms of whether consultation has begun, reports completed, regulations changed *etc*. Figure 6 provides an extract from the online report by the State of Victoria[19] on the progress of its ICT strategy as an example of how this can be done.

Figure 6: Extract from an online status report: Digital Victoria



Source: http://www.digital.vic.gov.au/status/ (as at 12 November 2013)

The European Commission and the Federal Communications Commission in the United States similarly maintain information about progress of their digital agenda and broadband plans on their *Digital Agenda for Europe* and *Broadband.gov* websites, with checklists marking progress in the work schedule.[20]

Ease of doing business

Broadband cannot be considered in isolation from the wider economy. Investors in broadband, as in any other sector, will be concerned about the overall conditions for doing business. The International

[19] In Australia's federal structure, states such as Victoria have a key role to play in the development of e-government and other elements of the digital economy.

[20] FCC 2010 Quarterly Broadband Action Agenda Items; European Commission Rules to support a competitive single market and to foster innovation and investment and Action 45: Foster the deployment of NGA networks

Finance Corporation and The World Bank maintain an online database[21] to monitor issues that will affect the prospects for investment, assessing a range of potential problem areas including:

- Starting a Business
- Dealing with Construction Permits
- Getting Electricity
- Registering Property
- Getting Credit
- Protecting Investors
- Paying Taxes
- Trading Across Borders
- Enforcing Contracts
- Resolving Insolvency

Problems in any one of these areas can be a serious impediment to broadband investment. In some countries the needs of the telecommunications sector have called for a more advanced legal and logistical framework than exists in the economy at large. For example, if construction permits are unduly difficult to obtain, the facilitation of civil works in telecommunications networks may require special arrangements to overcome the difficulties. In some countries, therefore, these essential investment conditions may also need to be referenced when monitoring the implementation of a broadband plan.

Monitoring broadband network deployment, availability and adoption

Table 3 outlines some of the key categories and characteristics to be considered in broadband infrastructure development for both fixed and wireless networks.

Table 3: Broadband construction overview and prospects for return on investment (ROI)*

<table>
<tr><th></th><th colspan="2">Fixed network</th><th colspan="2">Wireless network</th></tr>
<tr><th></th><th>Incumbent</th><th>New entrant</th><th>Incumbent</th><th>New entrant</th></tr>
<tr><td>Backbone / trunk routes</td><td rowspan="2">Fibre network construction as part of a capital equipment enhancement and replacement program: commercial ROI</td><td rowspan="2">New infrastructure requires access & interconnection to achieve a commercial ROI</td><td rowspan="3">Re-use of existing passive infrastructure: commercial ROI</td><td rowspan="3">New infrastructure requires access & interconnection: commercial ROI</td></tr>
<tr><td>Central business districts</td></tr>
<tr><td>Urban areas (small business & homes) – “brownfields”</td><td>Copper enhanced or replaced with fibre: longer-term ROI</td><td rowspan="2">Unbundled access generally required to achieve a commercial ROI: new infrastructure construction may provide a commercial ROI in some cases</td></tr>
<tr><td>New estates – “greenfields”</td><td>New capital investment in fibre: low maintenance cost: commercial ROI</td><td colspan="2">New infrastructure: commercial ROI</td></tr>
<tr><td>Rural and remote areas</td><td colspan="2">High cost and slow/negative ROI
New wireless infrastructure may be dominant over limited/declining/absent fixed line access</td><td colspan="2">New infrastructure required: possible universal service fund (USF) support: slow ROI</td></tr>
<tr><td colspan="5">Source: author
* Note: “commercial” or “slow” ROI are relative terms. In different countries and conditions the rate of return on investment may vary widely. In small island states, for example, the cost of international connectivity for small populations may bring additional challenges.</td></tr>
</table>

[21] The Doing Business website (http://www.doingbusiness.org/rankings) provides rankings and commentary on each issue.

It identifies some of the issues to be considered and monitored as broadband networks expand from profitable business centres and trunk routes into wider urban areas and out to rural and remote populations where the business proposition for commercial coverage may be difficult to establish. The deployment and adoption of broadband may need to be measured separately for each market segment.

Standardised broadband indicators are available in almost all countries and regular publication by the collecting authority makes it possible to track progress. The Nepal Telecommunications Authority's regular reporting, for example, includes information on internet access services provided by each operator as well as providing a breakdown of different technologies and the number of subscribers.[22]

The Polish regulator, the Office of Electronic Communications (UKE) annually updates its inventory of telecommunications infrastructure and public telecommunications networks that support broadband Internet access, including fibre and wireless networks as well as buildings that support collocation of facilities. The scope of data gathering, the electronic form of its submission and the map presentation format of the data are defined in an ordinance. UKE has also collected details of the current condition of the infrastructure and information on investment projects including fibre optic network terminations, telecommunications network nodes, access nodes, coverage with cable and wireless networks and penetration of cable connections or wireless terminals in buildings. This information is held in a dedicated database called the Information System about Broadband Infrastructure (*System Informacji o Infrastrukturze Szerokopasmowej*, SIIS). Detailed information is presented in the form of tables, charts and maps at the Polish province level (with information at the commune level).[23].

This information makes it possible to perform a detailed assessment of the condition of broadband infrastructure and to identify specific, long-term investment and development targets at the local level. Telecommunications companies and local government units, with the support of UKE, can use the data to help them in making effective investments in the infrastructure and in long-term planning of telecommunications infrastructure development. The data is also used to estimate the level of necessary investment (a key item in the National Broadband Plan). It helps local government and other local agencies in their decisions on investment projects financed with public assistance, and consumers can use it as a tool to help them select the most attractive telecommunications technologies and the most competitive market offers. UKE also publishes a report on coverage of the territory of Poland by telecommunications infrastructure. [24]

Other countries that make interactive maps available to consumers include Australia, Canada, Germany, Ireland, New Zealand, the United Kingdom, and the United States where a number of cities and states also provide broadband maps.[25] At the international level, ITU is currently mapping the deployment of backbone transmission capacity (both fibre and microwave) to enable governments to track and measure progress made in achieving their broadband infrastructure development goals (see figure 7). The map has capability to zoom from global to regional and local levels. [26]

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[22] Nepal Telecommunications Authority MIS Reports

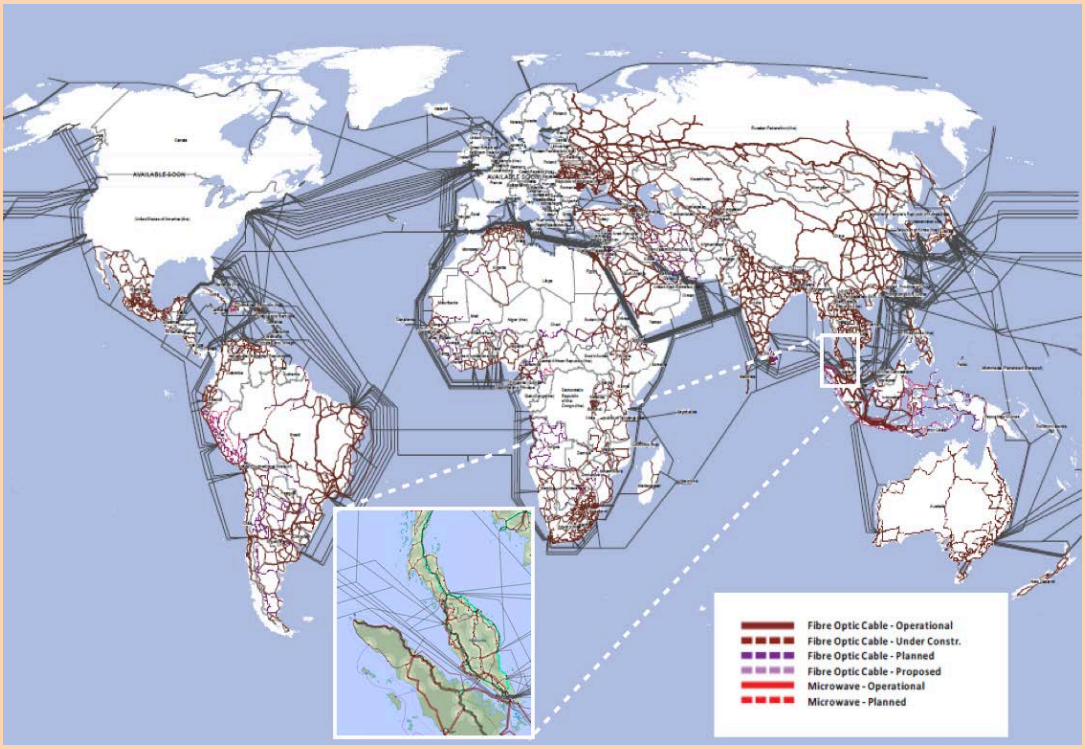
[23] Interactive maps presenting broadband infrastructure are available at http://maps.polskaszerokopasmowa.pl/maps .

[24] The Report of August 2013 (including investment projects implemented in 2012-2013, and buildings enabling co-location) is available in English on UKE website (http://en.uke.gov.pl/telecommunications-infrastructure-in-poland-12958). Anna Rogozińska, *From National Broadband Plans towards Broadband Ubiquity – the Polish Experience*, ITU-D Regional Conference on Speeding up NGN ubiquity, Athens, 13 February 2014, supplemented by correspondence with the author.

[25] Interactive broadband maps available online include: Australia (https://www.mybroadband.communications.gov.au), Canada (http://www.ic.gc.ca/app/sitt/bbmap/hm.html?lng=eng), the United States (http://www.broadbandmap.gov), Germany http://www.zukunft-breitband.de/Breitband/DE/Breitbandatlas/breitbandatlas_node.html, Ireland (http://www.dcenr.gov.ie/communications/communications+development/national+broadband+scheme.htm), New Zealand (http://www.broadbandmap.govt.nz), and the United Kingdom (http://maps.ofcom.org.uk/broadband/). In June 2013 the EC commissioned a study of current broadband mapping initiatives (http://www.broadbandmapping.eu/).

[26] Currently, data from 113 countries have been collected. For more information on this project and to access the interactive map, see http://www.itu.int/itu-d/tnd-map-public/

Figure 7: ITU's backbone transmission map – with an example of interactive regional mapping capability



Source: ITU, Telegeography, www.itu.int/itu-d/map-public/ Note: data collection for this map is a work in progress

In the United Kingdom, reports from the regulator Ofcom make comparisons with peer countries in Europe on measures of coverage, take-up, usage, price and choice.[27] In the United States, the Federal Communications Commission (FCC) is required to include information comparing the extent of broadband service capability (including data transmission speeds and price for broadband service capability) with a total of 75 communities in at least 25 countries abroad for each of the speed benchmarks for broadband service utilized by the Commission to reflect different speed tiers.[28] Most countries rely on ITU, OECD and other regional organisations to provide comparative information of this kind.

Monitoring the progress of a broadband plan is of most value when the information is shared. New Zealand and the United States both publish a great deal of information on the web although they approach the task in different ways. New Zealand publishes regularly updated information online about the progress of the Ultra-fast Broadband Initiative, the Rural Broadband Initiative and the connection of schools and rural hospitals. The report of 30 June 2013 (figure 8) can be considered as a model of concise reporting.

The United States' *National Broadband Plan: Connecting America*[29] provides a framework for expanding broadband connectivity, adoption and utilisation across the nation. The Plan put forward an initial universal service goal for broadband access at 4 Mbps of actual download speed and 1 Mbps of actual upload speed by 2020, estimating that in 2009 this level of access was already available to 95% of the population, largely as a result of private sector investment. The availability gap was greatest in areas with low population density where the business case for broadband networks was unattractive.

[27] Ofcom Report for Government on UK's broadband progress March 5, 2013

[28] FCC Eighth Broadband Progress Report, August 2012, page 52

[29] *National Broadband Plan: Connecting America*

Figure 8: New Zealand: Broadband deployment update as at 30 June 2013[30]

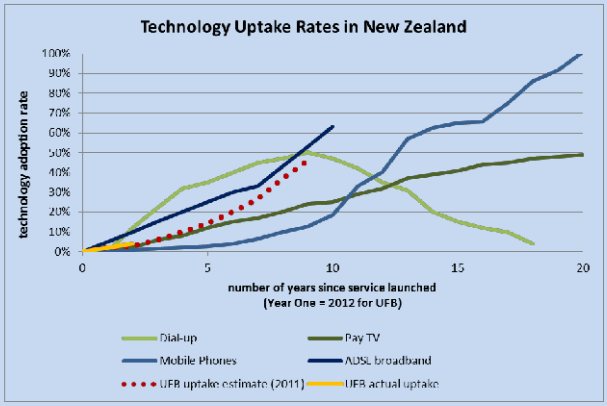
Ultra-fast Broadband Initiative (UFB)

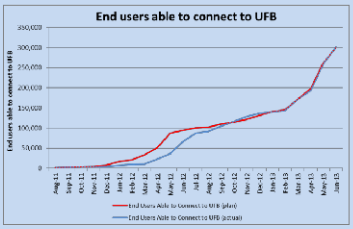
Connecting 75% of New Zealanders with fibre to the premise by end 2019. Fibre will be capable of peak speeds of at least 100Mbps.

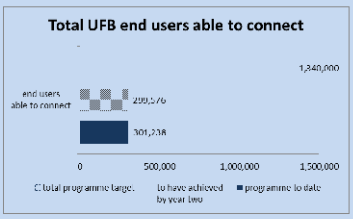
	# of premises able to connect			# of end users able to connect			# of connected users		
	quarter four	year two	to date	quarter four	year two	to date	quarter four	year two	to date
TOTAL	95,818	171,331	229,633	129,352	224,927	301,238	4,851	8,751	9,984

Number of retail providers actively offering UFB services: 50

Ultra fast broadband connections are now available in 26 candidate areas. For information on whether you can connect to UFB, please contact your retail service provider or go to www.broadband.govt.nz







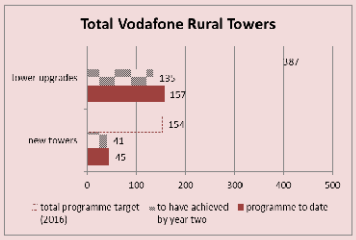
Rural Broadband Initiative (RBI)

Connecting 86% of rural homes and businesses (outside UFB areas) with broadband at peak speeds of at least 5Mbps by end 2015, through fixed wireless and improved copper services.

Vodafone

Role: provision of fixed wireless broadband capable of peak speeds of at least 5Mbps.

	quarter four	year two	to date
towers upgraded:	12	77	157
new towers installed:	9	32	45
households covered (approximate):	10,930	58,127	111,050

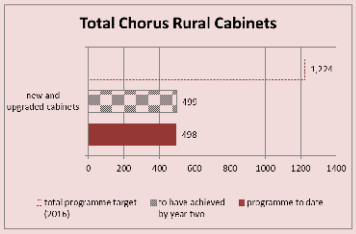


Chorus

Role: deployment of fibre to cabinets, offering improved broadband services. Some residences will receive copper-based broadband speeds of up to 20Mbps.

	quarter four	year two	to date
cabinets upgraded:	91	289	498
households covered (approximate):	7,720	31,092	50,120

Some rural homes and businesses will have the choice between copper-based broadband and fixed wireless broadband. Currently over 149,000 homes have access to RBI services.



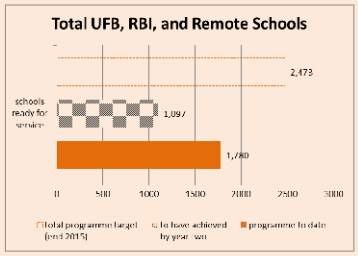
Priority Users

To be connected with fibre capable of peak speeds of at least 100Mbps through the UFB or RBI. Remote schools will receive point-to-point wireless connections capable of peak speeds of at least 10Mbps.

Schools

	quarter four	year two	to date
UFB: schools with fibre past the school gate	124	832	1008
UFB: schools with fibre connections (ready for service)	176	623	973
RBI: schools with fibre past the school gate	83	294	779
RBI: schools with fibre connection (ready for service)	83	313	774
remote schools (ready for service)	7	23	33

Note: The programme target covers state and state-integrated schools. It includes schools that have been connected to fibre outside of the UFB and RBI.



Hospitals

	quarter four	year two	to date
rural hospitals with fibre connections	8	24	28

Note: number of hospitals includes eight rural hospitals connected to fibre prior to the establishment of the RBI.

Source: [Ministry of Business, Innovation and Employment: Broadband Deployment Update]

[30] Quarterly updates continue to be published by the Ministry of Business, Innovation, and Employment

The importance of monitoring broadband progress is underlined by the legislative requirement for the FCC to initiate an annual notice of inquiry "concerning the availability of advanced telecommunications capability to all Americans (including, in particular, elementary and secondary schools and classrooms).

In conducting this inquiry, the Commission must "determine whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion." It must also provide demographic information for unserved areas. If the Commission finds that broadband is not being deployed to all Americans in a reasonable and timely fashion, the Commission is required to take immediate action to accelerate broadband deployment by removing barriers to infrastructure investment and by promoting competition in the telecommunications market.[31]

United States – Eighth Broadband Progress Report, 2012

As part of its statutory duty, the FCC has reported that many Americans live in areas where there is no business case to offer broadband; they have no immediate prospect of being served absent Commission action, despite the growing costs of digital exclusion. This was an important element in the Commission's finding "that broadband is not being reasonably and timely deployed and is not available to all Americans."[32] The speed benchmark adopted by the FCC for the purpose of this finding was 4 Mbps/1 Mbps – a benchmark that it will review in future inquiries.

Drawing upon its own resources as well as research findings from a variety of sources, the FCC's previous report had identified several barriers to investment, competition and adoption in these areas:

- costs and delays in building out networks;
- broadband service quality;
- lack of affordable broadband Internet access services;
- lack of access to computers and other broadband-capable equipment;
- lack of relevance of broadband for some consumers;
- poor digital literacy; and
- other reasons, such as consumers' lack of trust in broadband and Internet content and services, including concerns about inadequate privacy protections.

The FCC's *Broadband Progress Report* noted that the private sector was continuing to extend the reach of services. Barriers to broadband availability and adoption were also being overcome through the implementation of a number of programs managed by itself and other agencies to support the rollout and adoption of broadband services in tribal lands and other under-served areas, with a mix of strategies to support both the availability and adoption of broadband services through partnerships, targeted subsidies, and regulatory streamlining activities, noting that it continued to find strong interrelationships between deployment, competition and adoption. For example, universal service policies had been reformed to emphasise broadband access, and major funding was provided through the US Departments of Agriculture and Commerce, as well as the FCC, to provide grants and loans to support deployment in unserved, remote and high cost areas. Regulatory initiatives such as the *Pole Attachment Order* were launched to cut costs and accelerate deployment, and spectrum was being made available to support wireless broadband access. To support broadband adoption and overcome barriers of cost, literacy and perceived lack of relevance, programs such as *Connect to Compete* were collaborating with private and community organisations to assist low income users with low cost computers and Internet service, with content to support job skills and education, and with accessible digital literacy training programs.[33]

[31] FCC Eighth Broadband Progress Report, August 2012, page 8

[32] FCC Eighth Broadband Progress Report, August 2012, page 9

[33] FCC Eighth Broadband Progress Report, August 2012, page 62-69

The report focussed particular attention on the need to remove difficulties in accessing key requisites for broadband infrastructure, such as utility poles, conduits, rooftops, towers and rights-of-way. "These obstacles delay or prevent broadband deployment, and are likely to limit competitive entry, raise costs, lower service quality and have other negative impacts on businesses and consumers." [34] The response to these barriers clearly required cross-jurisdictional cooperation. This was ultimately given direction by the President's *Executive Order -- Accelerating Broadband Infrastructure Deployment* of June 2012.[35]

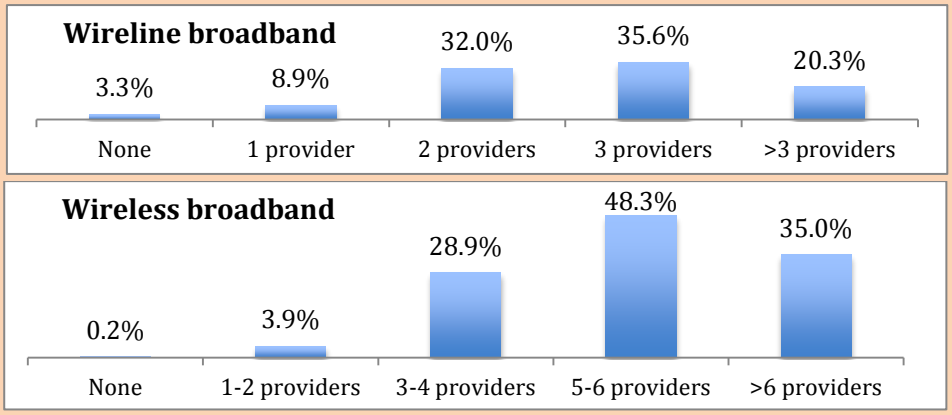
Source: author, adapted from FCC.

Future Broadband Progress Reports will continue to provide updated information on these issues – both in terms of the expansion of broadband availability and adoption and the progress of measures required to deal with the various barriers that have been identified.

Monitoring competition and wholesale access

While basic enabling measures can be reduced to a checklist, and standardised telecommunications indicators will measure broadband availability, monitoring the development of a competitive broadband market is important for those countries that rely on the market to do the great bulk of the work in achieving widespread and affordable broadband access. This requires information on the extent of infrastructure and service-level competition, and the interactive maps mentioned earlier can provide a useful way of monitoring the development of competition.

Figure 9: Nationwide availability of broadband in the U.S. by number of competing providers



Source: Adapted from Steven Rosenberg *Measuring and evaluating broadband progress,* Presentation for ITU Asia Pacific Centre of Excellence Training, October 2013*, based on the National Broadband Map at June 30, 2013*[36]

Figure 9 provides a breakdown of the competitive availability of broadband in the United States based upon information provided by State Broadband Initiative grantees[37] and incorporated in the National Broadband Map.[38] While figure 9 provides an indication of the extent of competition at the national level, the interactive features of the National Broadband Map enable users to obtain similar information also at state and local levels, identifying local broadband providers.

[34] FCC Eighth Broadband Progress Report, August 2012, page 62-63

[35] The White House Executive Order -- Accelerating Broadband Infrastructure Deployment, June 14, 2012

[36] In this case, the benchmark speeds used for broadband are 768 kbps down and 200 kbps up.

[37] The State Broadband Initiative (SBI – previously the State Broadband Data Development program) is discussed later under monitoring adoption of broadband.

[38] *Steven Rosenberg* Measuring and evaluating broadband progress, *Presentation for ITU Asia Pacific Centre of Excellence Training, October 2013*

In Europe, there is reporting on service as well as infrastructure-based competition, and action lines in the Digital Agenda support streamlined regulatory measures for wholesale access pricing.[39] The Commission monitors the extent of wholesale access from incumbents in terms of activated main lines, whether shared or fully unbundled lines, bitstream access or simple resale. This information is obtained from national regulators and is published online.[40]

Wholesale level information is also required in those cases where vertically separated models have been adopted for broadband provision. Two broad approaches to vertical separation can be distinguished:

- separation of wholesale and retail services by an existing incumbent (*e.g.*, the United Kingdom and New Zealand creating Openreach and Chorus, respectively), or
- creation of a new entity to supply basic infrastructure on a wholesale basis (*e.g.*, Australia and Singapore).

Although the United Kingdom and Singapore represent the first and second approaches respectively, they appear to be converging in their approach to monitoring the performance of the wholesale service provider and the achievement of rollout targets.

- In the *United Kingdom*, since the beginning of 2013, Openreach has committed to new contractual targets for services, leading to automatic payments to other telecoms companies where it misses those targets. Ofcom has also proposed new performance standards for Openreach with targets to be met in full from April 2016. Intermediate targets are also proposed to ensure progressive improvements in service. The Openreach website provides information on where and when superfast broadband is becoming available.[41]
- In *Singapore* OpenNet is the wholesale provider of Singapore's National Broadband Network (NBN). OpenNet's universal service obligation (USO) requires it to provide optical fibre services to any location in Singapore at the request of telecom or broadcast licensees. Operating companies and retail service providers rely on OpenNet's NBN to deliver services to consumers and businesses and OpenNet provides information about the availability of broadband service to specific locations on its website. In December 2013, the Infocomm Development Authority of Singapore (IDA) imposed a financial penalty of SNG $750,000 on OpenNet for failing to meet its USO from January to June 2013 as well as for breaching its Quality of Service standards. The IDA notice on this matter also reported that since July 2013 OpenNet has been accepting orders for fibre services to all homes and business end-users in observation of its USO.[42]

Close monitoring of broadband progress is also occurring in Australia and New Zealand, measuring progress against public statements of expectations and commitments. As the wider economy becomes more dependent upon fully integrated broadband and ICT services, the performance of providers at the wholesale level may be more closely monitored. As the IDA noted in their decision of December 2013, a performance lapse at the wholesale level affects downstream providers such as operating companies and retail service providers who rely on the wholesale network to deliver a wide range of services to consumers and businesses.

Before moving on, it is useful to reflect that while it is true that broadband indicators of availability are well established, many countries have adopted innovative ways to expand and apply this information:

- some provide greater detail and depth of information, even down to the local community level;

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[39] Digital Agenda for Europe Pillar IV: Fast and ultra-fast Internet access, actions 112-114

[40] European Commission Report: Fixed broadband wholesale lines & agreements, January 2013

[41] Ofcom New rules for faster telecoms repairs and installation December 19, 2013 and Openreach: Where and when

[42] OpenNet, homepage and IDA, OpenNet Failed to Meet Universal Service Obligation and Quality of Service Standards 20 November 2013

- some publish this information online to assist both users and suppliers in decision-making;
- some engage in regular reviews of progress, focussing particular attention on the identification of barriers and ways to overcome them; and
- in the case of countries where wholesale access is being rolled out in a vertically separated way, new approaches have been adopted to set requirements and hold the responsible body to account for the achievement of its targets and obligations.

Expanding broadband in unserved areas – project monitoring and evaluation

So far this paper has focussed on monitoring the development of broadband in areas where a commercial return on investment is generally achievable over an acceptable period of time and broadband plans can rely largely on the market or on a mix of commercial and regulatory incentives. In the most challenging rural and remote areas, as noted in table 3, the potential return on investment may be so poor that a business case does not exist for broadband deployment without a direct injection of public funds.

Whether or not a rural broadband project is formally part of a universal access policy, it may need to be monitored and evaluated in similar ways, recognising that broadband-capable networks are now being extended to areas that would once have been restricted to basic voice services.

Canada relies on market forces for the development of broadband, but in areas where the market has failed to deliver broadband Internet services on its own, the government has used targeted funding to support services in unserved areas. The formal evaluation of Canada's rural and northern development pilot project illustrates the value of evaluating such projects and publishing the lessons learned.

Canada: Evaluation of the Broadband for Rural and Northern Development Pilot

This Broadband Pilot Program was a CAN$105 million initiative between 2002 and 2007 to address the broadband gap between served and unserved communities. The objectives of the program included:

- Demonstrating the benefits of broadband in communities across Canada;
- Providing funding to unserved communities to prepare business plans for broadband services;
- Providing funding to unserved communities to help them implement broadband services that will assist in the areas of job creation, education, health, economic development, and governance;
- Creating opportunities for learning by sharing best practices among communities; and
- Creating new business opportunities, domestically and globally, for Canadian ICT companies.

Key findings of the evaluation included:

- CAN $4.2 million was invested in 154 projects, representing approximately 2,285 communities, to develop business plans that outlined their vision for the application of high-capacity Internet services.
- CAN $80.3 million was invested in the 63 projects, representing nearly 900 communities (including 142 First Nations reserves), in the form of a one-time investment in capital infrastructure implementation of broadband business plans.
- The number of communities yet to be served by broadband was reduced from 4,000 to 2,000.
- Ninety-three per cent of vendors and ninety-four per cent of project representatives indicated that without government assistance there is no business case for providing broadband services to rural and remote communities. If left to the market, only the most populated areas would be connected.
- The collaboration engendered by the project pushed up demand beyond what many providers and ISPs had expected.
- Broadband was extended to more communities than expected for two other reasons: when some communities heard that their neighbours were applying for the program they wanted to be included; and some vendors added more communities because network extension made it sensible to connect en-route communities as well as the project applicant communities.

The principal recommendation arising from the evaluation was that consideration be given to extending access to broadband services to a greater number of Canadian communities. It supported the existing "bottom up" community-based approach that appeared to have "a domino effect of increasing awareness of the benefits of broadband, which further increased the use of, and reliance on, broadband." Other recommendations focused on administrative improvements that could be considered in future programs.

Source: Industry Canada Audits and Evaluations: Formative Evaluation of the Broadband for Rural & Northern Development Pilot

The pilot program and its evaluation was followed up with the *Broadband Canada Program*, a three-year, CAN $225-million investment to bring faster internet to an additional 218,000 Canadians in underserved areas that ended in 2012.[43] The latest program under the *Economic Action Plan 2014* proposes to provide CAN $305 million over five years to extend and enhance access to high-speed broadband networks to a target speed of 5 megabits per second for up to an additional 280,000 Canadian households to achieve near universal access.[44]

The careful evaluation of pilot projects, whether as stand-alone broadband projects or within the framework of universal access programmes to ICTs helps to ensure that future public investments are well managed and it is good practice in any subsidy scheme to make monitoring requirements an integral part of the project design and management framework. The achievement of milestones, coverage targets and service obligations all require monitoring, to ensure cost-effective use of financial resources.

Best practices for effective management of funds are discussed in the OECD *Broadband Strategy Toolkit*.[45] The ITU/InfoDev *ICT Regulation Toolkit* also provides detailed guidance on practical matters including the monitoring and evaluation stages of the project.[46] Subsidy schemes used to support the adoption and take-up of broadband have the same need for transparency, accountability and efficiency as universal service funds, as reflected in a recent ITU study on that topic. [47]

Monitoring the adoption and use of broadband

While indicators of adoption and use are still being developed,[48] most countries have basic ICT statistics that can be used to support policy development and inform industry and users. On the demand side, many regulators already have some relevant information at hand including indicators of the number of customers measured by subscriptions, households, businesses and communities, where appropriate.[49] However, gaps in this information can be identified that need to be filled to provide a fuller understanding of user behaviour. For example, subscription information needs to be augmented with information about user choices of devices and patterns of use in order to be able to understand the real levels of access and affordability in a community and in order to estimate likely trends in demand.

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[43] Canadian programs have generally involved matching funding from other entities. Provincial programs and their relationship with federal government programs are reviewed in *Rajabiun, R., & Middleton, C. (2013). Rural Broadband Development in Canada's Provinces: An Overview of Policy Approaches. In W. Ashton & A. S. Carson (Eds.), [Special issue]. The Journal of Rural and Community Development, 8(2), 7-22.*

[44] Government of Canada Budget 2014

[45] OECD Broadband Strategy Toolkit, Section 4.4

[46] ITU/infoDev, ICT Regulation Toolkit - Universal Access and Service Module 4, Section 7 "Competing for UAS subsidies"

[47] ITU, Universal service funds and digital inclusion for all, September 2013

[48] For example, "adoption rate" can be defined as the number of people choosing to use a technology expressed as a fraction of the number to whom it is available. In this paper, unless the context indicates otherwise, "adoption" or "take-up" simply refers to the number of people using a technology, independent of availability.

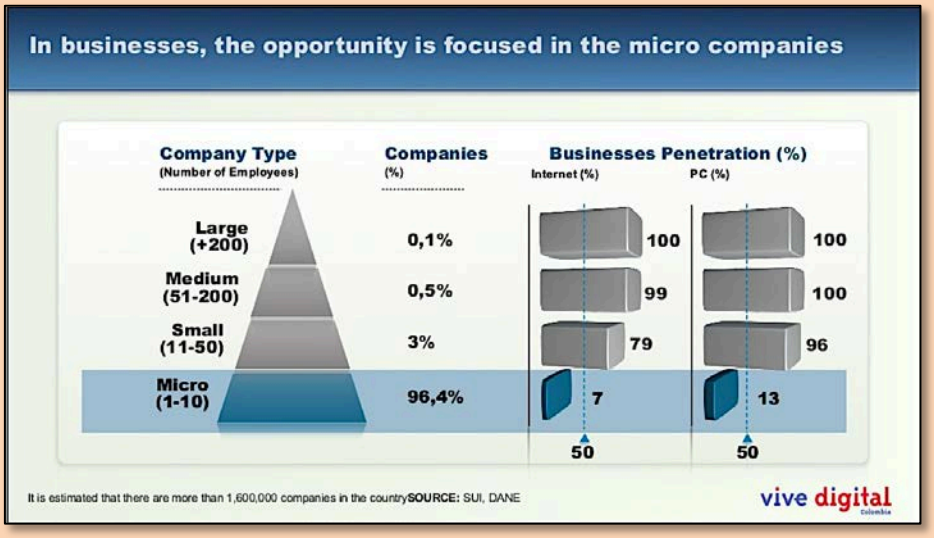
[49] It should be noted that in developing countries, the number of people taking advantage of "household" access could be much larger than in developed countries. Surveys of users may be the only way to measure these differences.

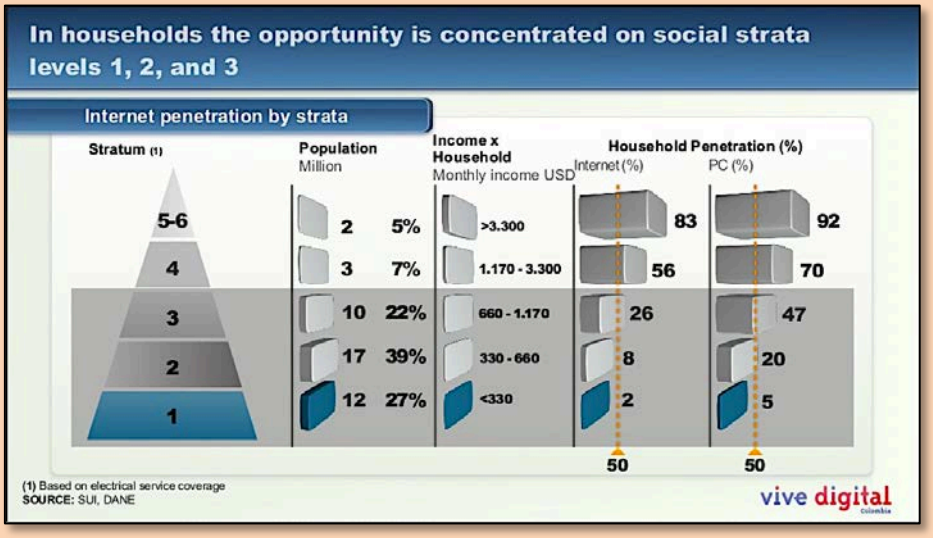
Additional information can be obtained from national statistical offices and from commissioned research, as will be seen in some of the examples to follow. National statistical offices rather than regulators may obtain general information about access to computers and the use of online services but ITU remains the leading international centre for aggregation of much of this information.

Some countries have very specific objectives in mind for the adoption and use of broadband that need to be supported by specialised information gathering. Colombia, for example, aims to extend broadband connectivity across the country's regions, and to stimulate adoption among the youth, within the poorest social groups, and by the country's smallest businesses. The policy is supported by efforts to measure the challenges, opportunities and progress in each of these areas.

Under Colombia's Digital Agenda, *Vive Digital*, work has already been undertaken to monitor the penetration and adoption of broadband by households at different levels of social strata and by small and micro businesses as shown in figure 10 using information sourced from the National Administrative Department of Statistics (DANE) and the Public Utility Superintendency (SUI).

Figure 10: Monitoring business and household penetration and adoption in Colombia





Source: Diego Molano Vega, Minister of Information and Communication Technologies, Colombia, Vive Digital - OECD Keynote, December 12, 2013

The *Vive Digital* Agenda also places high importance on the use of ICT in education and capitalizing on the proficiency of "digital natives" in the adoption of broadband. Low-cost services and customer premises equipment are offered to help bridge the social and regional gaps of Colombia by bringing ICTs to children

in rural and remote zones and by training teachers to be better acquainted with technology. According to an impact evaluation, the program reduces dropout rates, raises standardized test scores, and increases the probability that a child will enrol in higher education.[50]

At a regional level, the Economic Commission for Latin America and the Caribbean, has been working with collaborators including national statistical agencies, the Observatory for the Information Society in Latin America and the Caribbean (OSILAC), and the eLAC 2015 Indicators Commission to develop indicators and a statistical reference framework for assessing and monitoring the progress in the third phase of the *Plan of Action on the Information and Knowledge Society for Latin America and the Caribbean* (eLAC2015). This work aims to assess the region's progress compared with the rest of the developed world, allowing Governments and other stakeholders to draw their own conclusions about the effectiveness of their policies and the pace of progress in their respective countries.[51]

Canada provides another example of a country monitoring adoption patterns closely, with commissioned research providing feedback to the overall broadband policy agenda, with implications for the adjustment of broadband benchmarks and policy objectives.

Although Canada has relied primarily on private enterprise operators for the provision of broadband service with a variety of choices in terms of both price and quality, the Canadian regulator, the Radio-television and Telecommunications Commission in 2011 decided that an unregulated, aspirational minimum threshold of 5 Mbps downstream and 1 Mbps upstream should be considered the target for services to be available to all Canadians by 2015 and it stated that it would monitor progress towards this goal. At the same time it surveyed broadband access to provide a baseline against which to measure progress. It found that *availability* of 5 Mbps Internet service in small centres mainly kept pace with their larger counterparts, but availability declined rapidly for higher speed tiers. [52]

A follow-up report in 2013 found broadband availability to be 100% in urban centres and 83% in rural areas. [53] It also expanded the information on the *adoption and use* of broadband using survey-based information from the Media Technology Monitor (MTM) to monitor Canadians' choice and use of new and existing technologies. It found a complex and evolving picture with regard to the adoption of digital technologies, noting that in the use of digital media, product life cycles and consumer adoption patterns tended to move over time through a cycle of innovation, expansion and decline as shown in figure 11.

For example, *emerging* trends included online-only television viewing, *expanding* trends included possession of a smartphone, *maturing* trends included having a Wi-Fi network at home, and *declining* trends included listening to podcasts and subscribing to analogue cable services. This type of analysis demonstrates the value of considering consumer adoption and use of broadcast and online media in a fully "converged" manner. It also shows how changing patterns of adoption and use provide a feedback loop indicating changing demand for broadband capacity and availability, whether in terms of greater download capability or greater mobility. When broadband access can be wireless or wireline-based, multi-function consumer devices open up the range of consumer choices between streamed, broadcast and interactive services, with consumers able to engage with the digital world at the time and place of their choosing.

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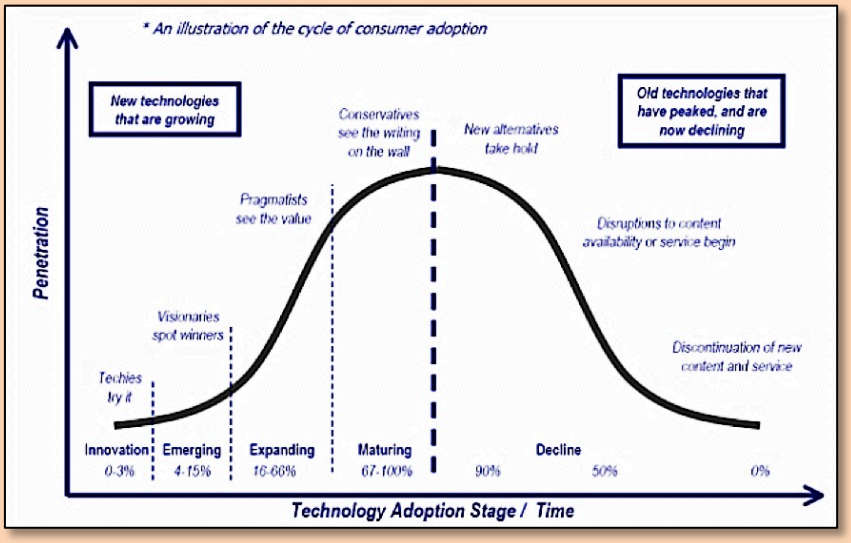
[50] Diego Molana Vega, Minister of Information and Communication Technologies of Colombia, "Colombia's Digital Agenda: Successes and the Challenges Ahead" in *The Global Information Technology Report 2013*, World Economic Forum

[51] Economic Commission for Latin America and the Caribbean, Monitoring of the Plan of Action eLAC2010: Advances and challenges of the information society in Latin America and the Caribbean, November 2010, page 9.

[52] CRTC Broadband Report November 2011, page 1 and 13

[53] CRTC *Communications Monitoring Report 2013: Broadband availability and adoption of digital technologies.* Data related to consumer behaviour was gathered primarily from contracted research and publicly available data rather than direct data collection. One of the primary data sources was the MTM Fall 2012 survey, which examined the media habits and technology usage of 8,000 Canadians 18 years of age and older.

Figure 11: Cycle of consumer adoption / product life cycle observed in Canada



Source: MTM 2012, from CRTC Communications Monitoring Report 2013

The Commission concluded that it needed to reconsider not only the availability of broadband Internet access service, but also the capacity requirements that must be met for participating in the digital environment, in the light of changing evidence about consumer behaviour. In its 2013-2016 Three-Year Plan, the Commission indicated that it would undertake a comprehensive review to determine what services (*e.g.*, voice, broadband) are required by all Canadians to fully participate in the digital economy.[54] Thus, as in the United States, monitoring of adoption and use of broadband provides an information base to support reconsideration of the benchmark objectives for broadband access.

Having seen examples of how countries are more closely monitoring adoption patterns, this section concludes with a brief review of some other key issues that may be measured in support of broadband adoption.

Affordability

Consumers are concerned about the price of broadband access, ahead of issues around service quality and choice. Users are sensitive to price, especially for a first purchase. Entry level pricing is the most important indicator of affordability, which regulators can measure locally, taking account of equipment as well as service costs. International comparability can then be established, for example to determine whether or not the Broadband Commission affordability target for basic fixed-broadband services at less than 5% of monthly gross national income per capita has been achieved.

Business adoption and feedback

Small business uptake of broadband is an important measure of adoption and a key building block for many e-services. Many countries already encourage and monitor adoption of broadband by micro, small and medium sized enterprises. Business users also provide a complementary source of feedback on broadband developments because they are early users of high-speed services and will quickly report problem such as market failings, service gaps, regional disadvantages, reliability and quality weaknesses, inflexible regulations and barriers to innovation. Their feedback to regulators should contribute to the overall assessment of the progress of broadband implementation.

[54] *CRTC Three-Year Plan 2013-2016*

Large users can also assist in monitoring the availability of skilled staff for both the demand and supply sides of the industry. Indeed, they may compete with broadband suppliers for talented staff and can provide important support for public-private partnerships that aim to build a specialised skills base for the broadband economy. In some cases, they may be willing participants in regional and community based partnerships to build skills at the local level – and can provide feedback on their progress and successes. Of course, informal assessments of human capacity and skills may need to be backed up by an actual survey of local conditions and resources - as was found in the Dominican Republic.[55]

Anchor institutions

In the United States, the importance of data gathering for broadband is demonstrated by the creation of the State Broadband Initiative (SBI)[56] as a competitive, merit-based matching grant program funded by the American Recovery and Reinvestment Act. The SBI is intended to increase broadband access and adoption through improved data collection, publicly accessible broadband maps, and statewide broadband planning. It is managed by the Department of Commerce through the National Telecommunications and Information Administration (NTIA). The National Broadband Map is one of the products of this initiative, providing a rich body of information not only on broadband availability, but also take-up by community anchor institutions as illustrated in figure 12.

Figure 12: Broadband take-up by community anchor institutions nationwide, USA

Community Anchor Institutions

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Institution	Total Number of Records	Subscribe to Broadband: Yes	No	Not Provided	Speeds Reported
Schools K through 12	131,522	74,379	793	56,350	70,468
University, College, other post-secondary	9,523	3,601	172	5,750	3,416
Libraries	22,558	14,816	444	7,298	13,393
Medical / Healthcare	59,305	12,888	1,227	45,190	11,376
Public Safety	56,034	12,881	3,062	40,091	8,864
Community Centers - Government support	39,173	25,075	1,144	12,954	21,915
Community Centers - Non-Government support	22,200	4,710	529	16,961	3,955

Source API Call

Source: National Broadband Map (http://www.broadbandmap.gov/summarize/nationwide)
Data provided by SBI grantees as at 30 June 2013

Digital literacy and inclusion

In 2011, the Broadband Commission noted that about 17% of the world's adults — 796 million people — still lacked basic literacy skills. Nearly two-thirds of these are women. The quality of education remains

[55] Edwin San Roman, Bringing Broadband Access to Rural Areas: A step- by- step approach for regulators, policy makers and universal access program administrators: The Experience of the Dominican Republic, ITU GSR 2009

[56] Formerly the State Broadband Data Development program.

very low in many countries and millions of children are emerging from primary school with reading, writing and numeracy skills that are far below expected levels. The state of literacy and digital literacy are fundamental issues for many countries.[57] The regulator may assist in dealing with these educational issues, but may not necessarily lead.

ITU's *Connect a School, Connect a Community* project[58] makes advice, training materials, applications and tools available so that these centres can also serve disadvantaged and vulnerable groups, including women and girls. It is important that school connectivity projects include methods to measure progress towards school connectivity, evaluate the results of Internet connectivity on basic literacy and advanced skills, and analyse the impact of broadband access on learning. Such reporting is important in order to ensure sustainability, particularly in the initial adoption stage.

In the Republic of Korea, digital literacy programs have targeted groups such as the elderly, farmers and housewives that might otherwise have been left behind. Similarly, the NTIA Broadband Adoption Toolkit shares best practices from broadband adoption and digital literacy projects in about 100 communities in the United States.[59] Both of these examples highlight the value of partnering with established community organisations that people know and trust to engage hard-to-reach populations and sharing information about their success.

Digital inclusion plans also need to monitor gender gaps[60] and access for people with disabilities – issues that appear in only a limited number of broadband plans as shown in figure 4. School and community-based projects can be important in dealing with these issues as well as providing information and education on cyber security and safety online. Programs such as these should to be monitored as important parts of the overall broadband plan.

Service quality and speed

As broadband use expands, service quality has become an increasing concern in some countries, particularly where advertised speeds greatly exceed the actual experience of users. An increasing number of regulators in places including Brazil, New Zealand, Pakistan, Poland, Singapore, Sri Lanka, the United Kingdom, the United States,[61] and Europe are moving to stricter measurement and reporting of fixed broadband service quality, starting with consumer information and in some cases moving to stronger measures. In Singapore, the IDA provides information to consumers on the performance of services as well as pricing in the form of interactive charts on its website.[62] Mobile service quality issues are more complex, but the FCC and Ofcom have work underway to measure mobile performance.

The European Commission found major discrepancies between advertised and actual speeds on fixed networks; on average European consumers received only 74% (more recently 75.6%) of the advertised headline speed. Consequently, regulators in the EU will be required to monitor quality of service and operators will be required to supply information on average speeds provided in normal and peak times as well as information on their data limits, and traffic management practices.[63]

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[57] Broadband Commission Broadband: A platform for progress June 2011, page 78

[58] Connect a School, Connect a Community

[59] NTIA Broadband Adoption Toolkit Shares Best Practices Across U.S. 2 May 2013

[60] Doubling Digital Opportunities: Enhancing the Inclusion of Women & Girls in the Information Society, A Report by the Broadband Commission Working Group on Broadband and Gender, September 2013

[61] In the United States, the *First Measuring Broadband America Report* identified ISPs that fell short of advertised speeds and a few months after the report was released, but the *Second Measuring Broadband America Report* found substantial improvement with consumers experiencing performance more closely aligned with what is advertised.

[62] http://www.ida.gov.sg/applications/rbs/chart.html

[63] European Commission, Commission adopts regulatory proposals for a Connected Continent 11 September 2013 and http://ec.europa.eu/digital-agenda/en/news/quality-broadband-services-eu-samknows-study-internet-speeds

In August 2013 the Australian Competition and Consumer Commission released a consultation paper on a proposal for monitoring fixed broadband performance. It reviewed international models and invited comments on an approach that would not report the experience of individual consumers, but it would show performance trends across different technologies, Internet service providers and regions.[64]

It seems likely that performance quality will be a prominent issue to be monitored as broadband becomes an increasingly indispensable part of social and economic development and the focus moves increasingly to key issues to be monitored in a fully integrated broadband environment.

Monitoring broadband integration

Is it possible to determine when a fully integrated broadband environment has been achieved? No single indicator is sufficient, but a number of indicators considered together may show that broadband has become a pervasive and indispensable part of social and economic life. For example, a regulator might consider that integration has been achieved when there is evidence of:

- ubiquitous availability of broadband connectivity,
- high levels of digital literacy,
- full coverage and utilisation of broadband among all key community and economic institutions,
- well advanced progress with digital inclusion, and
- universally affordable access.

A further indicator to consider is whether alternatives to online communication are becoming devalued, difficult or unavailable, increasing the cost and disadvantage of exclusion from broadband connectivity.

In the integration phase, pilot projects and community development programs give way to more mature and more fully connected eGovernment, eHealth and eEducation services. These areas, all seen as opportunities in the adoption phase, become close to essential facilities in the integration stage. A consequence for regulators is that they are obliged to give priority attention to monitoring and implementing measures to support this new level of reliance on broadband services including

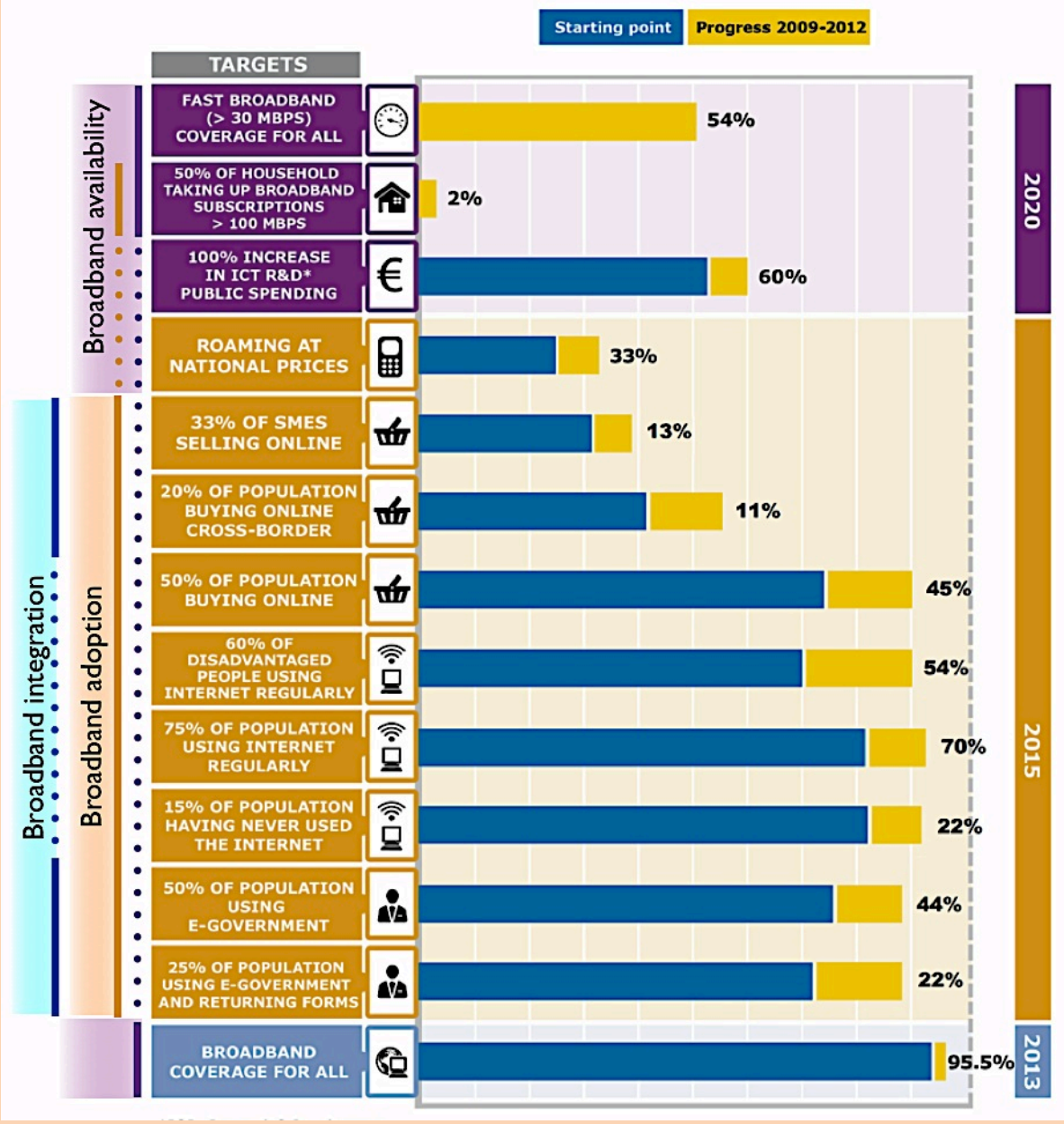
- the reliability, resilience and quality or broadband services,
- remaining gaps in digital inclusion and affordability, and
- security and safety online.

Europe's Digital Agenda forms part of the wider *Europe 2020* strategy for European Union growth in employment, productivity and social cohesion. The Digital Agenda also provides an example of the issues to be monitored in broadband plans that cover the gamut of issues from deployment of fast broadband and encouraging adoption by consumers and businesses, toward a more complete integration of broadband connectivity in social and economic life.

The Digital Agenda website maintained by the European Commission measures progress toward targets that have been set – with baseline data for each starting point shown in the Digital Agenda "dashboard" shown in figure 13. The website contains a wealth of other information including updates on work programs that contribute to each element of the digital agenda, the stages of work involved in the processes underway to overcome particular barriers, and information on how initiatives will work in practice.

[64] ACCC Broadband performance monitoring and reporting program

Figure 13: European Commission Digital Agenda



Source: European Commission, Digital Agenda Scoreboard 2012.
Sidebars on broadband "availability", "adoption" and "integration" added by the author.

Although ITU has already carried out work to measure the positive impact of broadband on wider economic activity it may be daunting to consider the expanded range of monitoring issues associated with the implementation of broadband plans when they become absorbed in wider agendas to advance national goals in areas such as improved government processes and performance, civic engagement, education, health, energy, research, development and innovation in the interest of broad social and economic progress. [65]

[65] Economic impact studies are brought together in Dr Raul L Katz The Impact of Broadband on the Economy: Research to Date and Policy Issues (ITU, April 2012)

Large business and government users will be among the first to provide feedback on any needs and deficiencies in broadband provision as their level of demand and dependence on high-speed connectivity expands. They also will be among the first to develop their own monitoring systems to assist in the management of increasingly complex, integrated and pervasive ICT networks that are central to their core business and heavily reliant on broadband connectivity.

Clearly, an ongoing process of monitoring and evaluation will be needed, and leadership will increasingly shift away from technology experts toward expert users as good practice models in each area of activity continue to develop.

The *National eHealth Strategy Toolkit* provides an important instance where fit-for-purpose data/telecommunications connectivity plays a supporting and essential role in the use and accessibility of information generated by advanced medical equipment. Monitoring the contribution of broadband finds a place in the wider landscape of monitoring costs, benefits and health outcomes.[66] As health administrators struggle with ever-expanding demands and costs, broadband-connected technologies offer scope for substantial savings and service improvements.

In the health sector, the "adoption" phase of broadband connectivity may appear as costly, although with long-term benefits; whereas in the "integration" phase it can become part of a larger ecosystem in which broadband enables multiple applications and uses. The *eHealth Toolkit* proposes a perspective for identifying short, medium and long-term approaches to be considered. This recognises the importance of demonstrating outcomes and benefits throughout the process of national strategy implementation, building and maintaining momentum and support for eHealth; and thereby improving the health of national populations.[67]

Some of the key points noted in this paper may be helpful in the ongoing dialogue with sectoral experts as the process of integration of high-speed broadband in wider social and economic life advances. In particular, it may be useful to recognise that short, medium and long term plans might need to reflect the phases of deployment, adoption and integration, with monitoring strategies tailored to each stage.

The benefits associated with the cost of deployment may not be fully realised until the adoption and use of broadband is taken up and new opportunities emerge in a more integrated broadband environment. Short term costs need to be weighed against long-term gains. Within each sector, sharing of information down to the local level, and closer attention to adoption patterns, areas of special need, and feedback loops can be helpful in developing a shared understanding of barriers, opportunities, priorities and appropriate benchmarks and objectives.

When broadband is fully integrated in society and the economy, attention turns to outcomes measured not only in terms of costs and savings, but also in terms of spill-over effects and overall gains in capability, efficiency, productivity, innovation and public welfare. New measures may need to be developed to monitor changes in people's behaviour and increased dependence on broadband-based services. Communications regulators will be well placed to assist their colleagues in other sectors as they work through these issues.

However, it would be wrong to focus solely on large business and government issues. Small business, covering a much larger proportion of the work force in most countries, also has an essential role in driving the uptake and use of broadband. The Australian Communications and Media Authority (ACMA) has therefore added some complementary and exploratory studies to its annual reporting on communications developments to include reports on topics such as Australian SMEs in the digital economy, which

[66] ITU and WHO National eHealth Strategy Toolkit 2012

[67] National eHealth Strategy Toolkit 2012, page v.

examined a range of issues including the intensity of online activity by small and medium sized enterprises, and also their exploration of new ways of doing business with online technology. [68]

ACMA has also found that Australian businesses are using mobile broadband to drive productivity, make faster decisions, improve product and service quality, and become more efficient and flexible. Its recent research report on the economic impacts of mobile broadband on the Australian economy, from 2006 to 2013 found that in 2013, mobile broadband led to an estimated increase in Australia's economic activity of AUD $33.8 billion. Of this, AUD $26.5 billion was attributed to time savings for businesses using mobile broadband.[69]

Studies such as these, and wider experience, continue to improve understanding of the way that broadband access is changing broader economic and social behaviour. The ways that people gather information, the way they work and relate to an expanding range of institutions, taking advantage of the opportunities for improved levels of capability, efficiency, participation and innovation are still being explored.[70]

All of this suggests that as dependence on broadband connectivity grows, it can be expected that regulators will continue efforts to monitor the availability, speed, affordability and reliability of broadband services and to overcome any remaining barriers to the adoption and effective use of high speed broadband connectivity.

4 Conclusions

A number of conclusions can be drawn from the research and analysis developed in this paper. When broadband plans are being developed and implemented, the following are recommended for consideration by regulators and policy coordination agencies as good practices:

- A monitoring and feedback framework should be considered to be a necessary part of any broadband plan. *Appendix A* provides an optional list of items for consideration.
- Consider ways of making the information widely available so that all stakeholders have the opportunity to make informed decisions about their own contributions to both the supply and use of broadband in an overall coordination framework.
- Consider ways to ensure that broadband indicators are in place to provide feedback on progress against targets for the expanded deployment and adoption of broadband services, with indicators that provide a basis for international comparisons.
- Consider appropriate indicators of broadband adoption and use that are relevant to local communities, groups and regions with special needs. Consider in particular ways to recognise and highlight innovation in the use and application of broadband and demonstrations of new capabilities enabled by broadband.
- Consider ways to ensure not only that outcomes are measured appropriately, but also that important process milestones are identified and progress reported in a transparent manner, for example on a public website.

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[68] ACMA *Communications report 2012–13* and *Report 1 – Australian SMEs in the digital economy*. ACMA has also published a series of brief "snapshot" reports on topics such as *Australians cut the cord: becoming mobile only, The connected business,* and *Home is where the work is: the digital worker*

[69] Two reports were commissioned by ACMA: The Centre for International Economics reported on *The economic impacts of mobile broadband on the Australian economy, from 2006 to 2013,* and Woolcott Research reported on *The business mobile communications usage and impact survey.* Both reports are accessible from the ACMA website at http://www.acma.gov.au/theACMA/engage-blogs/engage-blogs/Research-snapshots/The-mobile-business.

[70] See also: NTIA report explores how and why people connect to the Internet, 7 June 2013 and the work of the Institute for a Broadband-enabled Society.

- Consider ways to ensure that contracts, licences, projects and programs have built-in monitoring and feedback requirements to ensure that their reach, costs, benefits and outcomes can be measured, and to assist in identifying implementation problems that may require correction.
- Consider the need to adjust measures over time as priorities shift from deployment of services, to their adoption and use, recognising that when broadband is fully integrated in social and economic life it may shift from being seen as a *cost* and be recognised an essential underpinning and a means of *savings* across wider social and economic sectors.
- Consider ways to collaborate beyond the communications sector to monitor developments with a view to measuring short, medium and long-term outcomes in sectors such as health and education where improvements in capability as well as reach and efficiency, may be achieved in cost-effective ways after initial hurdles associated with deployment, adoption and capacity-building have been overcome.
- Consider ways to contribute and participate in the ongoing discussion of broadband impacts on social and economic life with a view, where necessary, to reviewing established benchmarks for broadband capacity as demand and usage continues to develop.

* * *

Appendix: A monitoring checklist for implementation of a broadband plan

For every country, the targets to be achieved will reflect local circumstances. Process milestones will also be unique to each country, depending on the regulatory, contractual, economic and other constraints that apply. The following checklist is therefore a guide only to the elements to be considered in each country when considering their own information gaps and ways to overcome them.[71] The broad categories set out below are intended to assist the identification of specific nationally relevant objectives and actions.

Checklist of optional elements to be considered in a monitoring framework for implementation of a broadband plan

Objectives and actions	Target date	Status
Enabling framework for broadband development		
Enabling measures		
• Broadband plan in place		
• Key stakeholders consulted		
• Coordination framework in place		
• Cross-sectoral support for key strategies & objectives		
• Monitoring and evaluation process established		
• Targets and process milestones established		
• Reporting in place for process milestones and progress		
• Reporting in place for achievement of targets and outcomes		
• Taxes, duties, fees minimised to support the broadband plan		
• Affordable user equipment		
Regulatory framework		
• Regulatory scope is sufficient to support the broadband plan		
• Regulatory capacity is built up and maintained		
• Education and training priorities identified and implemented		
• Licensing to facilitate broadband service expansion		
• Unified and technology-neutral licensing framework established		
• New model licences issued		
• Licence conditions in place and monitored		
• Spectrum arrangements support broadband rollout		
• Policy framework for wireless broadband access established		
• Timetable established for provision of spectrum for broadband		
• Services cleared to enable wireless broadband access		
• Wireless broadband access spectrum allocated and assigned for use		

[71] The form of this checklist is modelled on the example provided by the Victorian Government's ICT Strategy Action Checklist which is available online at http://www.digital.vic.gov.au/status/. In some cases that checklist uses simple graphics as well as text to indicate progress through the stages of a project as shown in figure 6.

Objectives and actions	Target date	Status
• Civil works facilitation		
• Multiple approvals streamlined		
• Access to key requisites (poles, roofs, towers etc.,) facilitated		
• Sharing and interconnection measures facilitated		
• Cost-based interconnection facilitated		
• Infrastructure sharing permitted/facilitated		
• Gateway access facilitated		
• Open access on commercial terms established		
• Diversity of access established		
• Backbone coordination facilitated		
• Consultations with stakeholders undertaken		
• Framework for cooperation agreed		
Broadband deployment and availability		
Broadband indicators in place		
• Telecommunications/broadband indicators established		
• Regulator reporting from operators in place		
• Analysis capability established		
• Broadband availability indicators by market segment		
• Central business districts		
• Urban areas		
• Rural and remote areas (*mapping may be required*)		
• Fixed and wireless technologies		
• Basic and advanced speeds		
• Interactive or published map of broadband availability		
• Price of basic and advanced services		
• Waiting times for service supply and restoration		
• Technology and devices in use		
• Updated to reflect changing usage and adoption patterns		
• Key barriers identified		
• Process to deal with identified barriers established and reported		
• Process milestones identified and reported		
Broadband competition monitoring		
• Infrastructure and service-based competition measured		
• Number of shared and unbundled lines reported		
• Maps of competing service availability		
• Surveys of uptake of competing retail services		
• Opportunities for co-located facilities identified and made available		

Objectives and actions	Target date	Status
Open access wholesale services		
• Access and deployment targets set and reported		
• Procedures in place to deal with delays and shortfalls		
Broadband adoption and use		
Key indicators		
• Broadband adoption - subscriptions/take-up		
• Technology platform and speed		
• Demographic categories including target social and age groups		
• Level of usage		
• Technology and service preferences and usage		
• Volume of data traffic (usually download volumes)		
• Uptake of broadband offerings by speed of download		
• Take-up by small and medium sized businesses surveyed		
• Number of small & medium sized businesses with online presence		
• Number of government agencies with online presence		
• Speed and capacity benchmarks updated to reflect usage trends		
Barriers to adoption and effective use		
• Broadband affordability		
• Cost of entry-level access as a percentage of income		
• Indicators of affordability by demographic sub groups		
• Indicators of take-up of subsidised terminal equipment		
• Broadband service quality		
• Service quality checks in place		
• Information published on measured service speed and latency		
• Comparison of advertised and experienced service published		
• Poor digital literacy		
• Skill levels surveyed and skill gaps identified		
• Training programs completed		
• Number of graduates of training programs		
• Barriers to digital inclusion		
• Survey gender participation rates		
• Measure uptake of services by people with disabilities		
• Other potential barriers		
• Level of interest and community concerns		
• Periodic /local surveys to identify perceptions of potential users		

Objectives and actions	Target date	Status
Outcomes for adoption and digital inclusion		
• Changing patterns of device and service usage monitored over time		
• Monitoring of target groups – by status, age, gender or disadvantage		
• Usage innovations identified and shared with other stakeholders		
• Educational and health outcomes monitored and shared		
Broadband integration		
Key indicators		
• New and emerging measures of		
• Technology engagement		
• Technology dependence		
• Intensity of use		
• Use of e-commerce		
• Use of e-government services		
• High speed broadband take-up		
• Cost and speed		
• Choice and usage		
• High speed broadband access		
• Number of competing suppliers		
• Coverage by competing suppliers		
Institutional synergies		
• Broadband integration in business practice		
• Volume of online marketing, sales and transactions		
• Extent of online recruiting, training and other business systems		
• Short, medium and long-term strategies in place for		
• Broadband integration in e-government agenda		
• Broadband integration in health agenda		
• Broadband integration in education agenda		
• Broadband integration in public safety agenda		
• Qualitative reports of increased capability and innovation		
• Studies of changing behaviour and practices		
• Consumer behaviour		
• Worker participation		
• Civic engagement		

Objectives and actions	Target date	Status
Project management and monitoring		
Subsidised deployment projects and programs		
• Transparent monitoring of tender procedures and outcomes		
• Process milestones identified and reported		
• Reporting responsibility clearly assigned in contracts		
• Targets established with regular progress reporting requirements		
• Coverage commitments mapped and progress reported		
• Transparent monitoring of progress against targets		
• Independent evaluation of project outcomes in place		
Subsidised adoption projects and programs		
• Transparent monitoring of tender procedures and outcomes		
• Reporting responsibility clearly assigned in contracts		
• Qualitative reporting on demand promotion projects:		
• Demand aggregation		
• Community anchor tenants		
• Government anchor tenants		
• Independent evaluation of subsidised projects and outcomes		
• Cost/benefit reporting for ongoing subsidised programs		

List of Abbreviations

ACMA	Australian Communications and Media Authority
BT	British Telecom
DSL	Digital subscriber line
CFH	Crown Fibre Holdings
CRTC	Canadian Radio-television and Telecommunications Commission
DANE	National Administrative Department of Statistics
eLAC	Plan of Action on the Information & Knowledge Society for Latin America & the Caribbean
FCC	Federal Communications Commission
GDP	Gross Domestic Product
ICT	Information and communication technology
IDA	Infocomm Development Authority
ITU	International Telecommunication Union
KPI	Key performance indicator
MDGs	Millennium Development Goals
MTM	Media Technology Monitor
NBN	National Broadband Network
NTIA	National Telecommunications and Information Agency
OECD	Organisation for Economic Co-operation and Development
Ofcom	Office of Communications
OSILAC	Observatory for the Information Society in Latin America and the Caribbean
OTT	Over the top
PPPs	Public-private partnerships
PSTN	Public switched telephone network
PWDs	People with disabilities
RBI	Rural Broadband Initiative
ROI	Return on investment
SBI	State Broadband Initiative
SME	Small and medium-sized enterprise
SUI	Public Utility Superintendency
UFB	Ultra-Fast broadband
UKE	Office of Electronic Communications
UNESCO	United Nations Educational Scientific and Cultural Organization
USF	Universal service fund
USO	Universal service obligation
WHO	World Health Organisation
WSIS	World Summit on the Information Society