Module 1: Policies and Regulation to Promote School Connectivity

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Introduction

Many countries are realizing the importance of connecting their educational institutions to the Internet.? Connectivity provides many benefits including access to an ever-growing volume of educational information, opportunities for collaboration and the use of on-line applications.? In addition, it is important for students, as well as teachers, to learn information and communication technology skills to enable them to participate in the evolving knowledge society.? School connectivity also helps enhance educational administration through the electronic exchange of forms, data and other information.? It also achieves cost efficiencies by automating manual tasks and reducing expenses associated with textbook printing and distribution.? The benefits are particularly attractive for remote schools where Internet access provides the vehicle for online learning and access to educational content. ?

The policies that enable schools to benefit from broadband connectivity can also be leveraged as vehicles to provide connectivity to marginalized and vulnerable groups, such as persons with disabilities, the elderly, the unemployed, minorities and indigenous peoples.? This module can thus also serve as a tool for considering the ways in which access to broadband can benefit groups with special needs. ?

Many of the benefits identified are only achievable through school broadband connectivity, the focus of this module.? The module also mainly examines primary and secondary school connectivity since this is the emphasis of most ICT infrastructure for education initiatives.? Section 1 one elaborates on the benefits of broadband connectivity.? Section 2 identifies international and regional goals and targets in respect to school connectivity.? The role of planning for achieving school connectivity, including key elements for consideration in implementing and funding Internet access in schools is described in Section 3.? Section 4 examines the potential of leveraging the investment in school connectivity to serve a wider audience outside school hours.?

The module primarily concentrates on ways to achieve connectivity itself and does not consider the next step of incorporating broadband into the school environment. ?Section 5?focuses on topics such as broadband curriculum, training and online content along with a number of cross cutting issues?including child online protection and one to one computer initiatives required for the next step.?The one to one computer model is discussed in detail in?Module 2. ?Section 6 provides several case studies on different countries experiences on providing Internet access to schools.

1 Importance of connecting schools

As *information and communication technologies* (ICTs)?become increasingly integral?to interactions between people, businesses and governments, policymakers are recognizing the benefits of improved and expanded broadband connectivity.? In particular, policymakers and educators now understand that broadband connectivity for schools can have a wide array?of short-term, medium-term and long-term benefits.

1.1 Short-term importance

?In the short term, Internet connectivity can provide a boost to teaching resources and administrative efficiency for local schools and school districts.? The short-term benefits of connecting schools to the Internet can be summarized as (1) ?Access to content and tools; and (2)?Improved access to existing resources.

1.1.1 Access to content and tools

In the short term, extending broadband connectivity to schools enables educators to take advantage of new and emerging content and tools that update and enrich curricula while providing individual instructors with tools that can facilitate and expand collaboration with colleagues both near and far.

?For several decades,?radio and television have been used to augment education in classroom settings, and to connect rural students to educational opportunities.??Today, the power of?computers and the availability of broadband connections enable a greater expansion of the types of content available, allowing?higher?levels of interactivity in educational settings.?

Broadband connectivity allows students and teachers access to current online research and instructional materials that can include images, audio recordings, and videos.??These materials augment and complement?more traditional oral instruction and written materials.? Combined with tools that allow for collaboration among students and teachers, broadband-enabled educational tools have

the potential to be a "disruptive" but positive force in educational programs around the world, enabling the creation of more effective and engaging educational models.?

1.1.2 Improved access to existing resources

When broadband service replaces a slower Internet connection, such as dial-up service, students and educators?gain?improved access to existing resources and materials that previously may have been too time-intensive to download --?or were simply unavailable without the bandwidth provided by broadband connectivity.

Broadband connectivity also provides new opportunities and additional value to coursework designed to train people to use ICTs.??This transforms isolated personal computers (PCs) or computer labs into tools for accessing information from around the world.

Despite significant differences in levels of development and educational programs around the world, broadband-enabled educational tools can be incorporated into curricula across all socioeconomic levels.??Specific areas of focus can?be customized to suit the needs of each community.

1.2 Medium-term importance

Beyond the short-term gains of Internet connectivity, schools with sustainable connectivity can begin to look forward to significant medium-term benefits, including (1)?improved student performance, (2) timely access to new resources, and (3) generating interest in ICTs in the?wider community,.?

1.2.1 Improved student performance

In the medium term, changes to educational curricula spurred by the introduction of online content and research tools have the potential to improve student performance.? Although there is little conclusive research to date quantifying the impact of ICTs in education, efforts are under way to evaluate progress?and to guide policymakers going forward.

A May 2009 review carried out for the United States Department of Education[1] examined available studies of ICT-enabled instruction in order to?explore?the effectiveness of such methods in the United

States.? The review found a statistically significant increase in performance among students who took all or part of a course online, rather than with?traditional classroom instruction.??But the review also noted:

1.?The?relatively small number of controlled studies on the subject,

2.?The fact that most studies were based upon university and graduate students, and

3.?That the introduction of online media alone had less of an impact than a deeper reorganization of the way instruction was presented or oriented.?

As additional work is carried out on?monitoring and evaluation of ICTs'? effectiveness?in education, policymakers and educators will have additional data to use in designing curricula and initiatives to?maximize the benefits of ICTs in the classroom.[2]

[1] U.S. Department of Education, "Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies, "May 2009, http://www.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf.

[2] For example, the World Bank's infoDev unit, in partnership with a range of organizations, is conducting studies and identifying best practices and lessons learned in the use of ICTs for education.

1.2.2 Timely access to new resources

In addition, broadband connectivity has the potential to reduce the time needed for new policies, curricula, and research tools to become available to students.

Generally, the?delivery of?books, videos -- even multimedia instructional materials delivered on CD-ROM or DVD --?lags behind the development of those materials,?particularly in?developing countries and rural areas.? Broadband connectivity can serve as an equalizer, making current, and even experimental, materials more readily available to educators in a timely fashion.

Moreover,?broadband connectivity enables interactivity?not only among students, or between students and teachers.? It can?even allow the teachers' and students' use of online resources to inform content developers as they update existing resources and develop new tools.?

1.2.3 Generating interest in ICT outside schools

There is also evidence that the use of broadband connectivity as an educational tool for children acts as a motivating force for parents to obtain broadband service at home.[3]? Increased demand then?attracts interest from governments and other organizations that may want to?fund broadband deployment.? Growing demand also helps?commercial network operators that otherwise might be?hesitant to offer services without a reasonable business case built on sustainable demand levels.?

In addition to serving educational needs, broadband-connected schools can serve as ICT centers for their surrounding populations.? In areas where low income, lack of infrastructure or other factors may present barriers to widespread broadband connectivity, policymakers can focus on using key public institutions -- including?schools -- as ICT centers that offer access, training, and support services.?

[3] Comments by multiple panelists in U.S. FCC workshop, “Programmatic Efforts to Increase Broadband Adoption and Usage – What Works and What Doesn't?” 19 August 2009.

1.3 Long-term benefits

?Deploying ICTs in schools is a long-term investment.? But the pay-off for sustainable support of connectivity is a host of long-term benefits, including:

* Improved technical and research skills

* Improved access to social services

* Improved access to markets and to goods and services.

1.3.1 Technical and research skills

Over the?long term, broadband connectivity in educational settings can be leveraged to ensure that students grow up with some level of familiarity,?not?only with?basic operation of devices such as PCs, but also with the online resources that are available?across the world.? Such resources are rapidly

growing, providing?tools to enable research, collaboration, communication, trade, civic participation, and access to government services.?

By enacting policies intended to teach a generation of students how to access and contribute to online resources, policymakers can help create?adults who are able to use?local and global online resources?for greater individual participation in national and global economies.? This, in turn, contributes to?broad socioeconomic development that is a key goal, particularly in?developing countries.

For these reasons, improving and expanding connectivity for educational institutions is often a key component of national development plans, as well as?national ICT plans and policies.? While ICTs are key tools in enabling and promoting socioeconomic development, research has indicated that investment in ICTs alone is not as effective as investment in ICTs and?education together.[4]

Encouraging evidence exists?that developing countries are – in one fashion or another – taking educational goals into account in their ICT development plans.? A 2007 survey carried out by infoDev found that among 48 African countries that had (or were developing) a national ICT plan, 39 also had (or were developing) plans for including ICTs in their education sectors.[5?]

While plans for including ICTs in education programmes should address goals beyond connectivity,?broadband connectivity?certainly is a?logical component of new and updated sector plans -- for both ICT and education.? Coordinating these plans and efforts can?provide a key means?to expand opportunities for socioeconomic development.?

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[4] Morawczynski, Olga and Ojelanki Ngwenyama, “Unraveling the Impact of Investments in ICT, Education and Health on Development: An Analysis of Archival Data of Five West African Countries Using Regression Splines,” *The Electronic Journal on Information Systems in Developing Countries*, Vol. 25 (2007), No. 5, pp. 1-15.

[5] infoDev*, Survey of ICT and Education in Africa: A Summary Report Based on 53 Country Surveys*, p. 6, http://www.infodev.org/en/Document.353.pdf.

2 International, regional and national initiatives, goals and targets for connecting schools

Various international and regional connectivity initiatives have been established to encourage the integration of ICTs into educational programmes and curricula.??Most, if not all, of the existing initiatives are guided by?principles established by the United Nations' Millennium Development Goals (MDGs), the World Summit on the Information Society (WSIS), and the World Education Forum's Education for All (EFA).? These?international and regional initiatives provide countries with guidelines to?set targets for school connectivity.

2.1 International initiatives

The goal of providing ICT access to schools is a global?one.? It has attracted support and contributions -- from a financial and intellectual standpoint -- from multiple international organizations, including the?ITU, the United States and others.? Some of their efforts?have been embraced through (1) the Millenium Development Goals (MGDs), (2) the World Summit on the Information Society (WSIS), and (3) the World Education Forum.?

2.1.1 Millennium Development Goals (MDGs)

In 2000, world leaders adopted the United Nations Millennium Declaration,?an effort to foster a global partnership?to reduce extreme poverty.? The initiative?established a series of time-bound targets, with a deadline of 2015.? These targets, known as the Millennium Development Goals (MDGs), establish specific development objectives including eradicating poverty and improving access to health and education.[6]

Of the eight MDGs, two targets involve the accessibility and improvement of education.? Goal 2 aims to achieve universal primary education so that by 2015, children everywhere (both boys and girls) will be able to complete a full course of primary schooling.[7?] Goal 3 of the MDGs focuses on promoting gender equality and empowering women.? It aims to eliminate gender?disparity in primary and secondary education,?preferably by 2005, and?at all levels of education no later than 2015.[8]

Although these MDGs do not deal directly with the establishment of school connectivity, their focus on providing education has set the stage for countries to focus?their efforts on developing?policies for?improved educational accessibillity.??The establishment of school connectivity can help governments to?achieve the MDG education goals:?

“The MDGs in education are defined in terms of participation and completion of primary education by all children and the elimination of gender discrimination in education.? ICTs play an important role in reaching these goals by?transcending time and space, allowing learning to take place 24 hours a day, 7 days a week.? This contributes immensely to the inclusion of traditionally excluded populations such as girls and women, ethnic minorities, and persons with disabilities - groups previously marginalized due to cultural, social and geographical circumstances.” [9]

[6] The Millennium Development Goals, available at: http://www.un.org/millenniumgoals/bkgd.shtml

[7] The Millennium Development Goals Report 2008, pg. 12.

[8] The Millennium Development Goals Report 2008, pg. 16.

[9] http://unpan1.un.org/intradoc/groups/public/documents/gaid/unpan034975.pdf.? The ITU provides specific examples of how ICTs impact the MDGs in: http://www.itu.int/ITU-D/ict/publications/wtdr_03/material/Chap4_WTDR2003_E.pdf.

2.1.2 World Summit on the Information Society (WSIS)

The International Telecommunication Union's (ITU's) Plenipotentiary Conference of 1998 recognized that ICTs could be used as a vehicle to achieve the MDGs.? As a result, the ITU proposed to hold a World Summit on the Information Society (WSIS)[10] to provide a global forum where all stakeholders could help?develop a framework for the Information Society.? The goal was to?establish a strategic plan of action with clear objectives, identifying?the needed resources and?the roles to be played by the different partners involved.[11]

In 2001, the ITU Council decided to hold the WSIS in two "phases."? The first phase was held In 2003 in?Geneva, where governments adopted the Declaration of Principles and Plan of Action for WSIS.??The Declaration?identified 11 key principles for building an inclusive Information Society.? One of those -- the principle of capacity building -- stressed the importance of literacy and universal primary education in achieving an all-inclusive Information Society.

The 2003 Plan of Action?covered 16 capacity-building?areas, including fostering domestic policies to integrate ICTs at all levels of education and developing and supporting programmes to eradicate illiteracy and promote e-literacy skills for all.[12]? It also recommended removing gender barriers to ICT education and empowering ICT use in rural and underserved communities.[13]? Furthermore, taking into consideration different national circumstances, the 2003 Plan of Action proposed possible national targets, including one on connectivity in educational institutions that called for countries "to connect universities, colleges, secondary schools and primary schools with ICTs."[14]

The implication is that all educational institutions should be connected by the target date of 2015.? The 2003 Plan of Action proposed implementing?appropriate international performance evaluation (both qualitative and quantitative) and benchmarking strategies at national, regional, and international levels.? This would allow?monitoring of?countries' progress in?implementing the objectives, goals, and targets outlined in the Plan of Action.[15]

The second phase of WSIS, meanwhile, was held in Tunis in 2005.??Participating countries produced the?Tunis Commitment and the Tunis Agenda for the Information Society.? The Tunis Commitment recognized that “ICTs have enormous potential to expand access to quality education, to boost literacy and universal primary education, and to facilitate the learning process itself”.[16]? This?reinforced support for the provision of universal, equitable and affordable access to ICTs.

The Tunis Agenda for the Information Society pointed out that greater financial resources were needed to increase broadband capacity and facilitate the delivery of a broader range of services and applications, as well as to support investment and offer Internet access at affordable prices to both existing and new users.[17]

[10]? World Summit on the Information Society (WSIS), Basic Information: About WSIS, available at: http://www.itu.int/wsis/basic/about.html

[11]? Resolution 73 of the ITU Plenipotentiary Conference, Minneapolis 1998, available at: http://www.itu.int/wsis/docs/background/resolutions/73.html

[12]? Plan of Action? for World Summit on the Information Society, December 2003, available at: http://www.itu.int/wsis/docs/geneva/official/poa.html

[13] Plan of Action? for World Summit on the Information Society, December 2003, available at: http://www.itu.int/wsis/docs/geneva/official/poa.html

[14] Plan of Action? for World Summit on the Information Society, December 2003, available at: http://www.itu.int/wsis/docs/geneva/official/poa.html

[15] Plan of Action for World Summit on the Information Society, December 2003, available at: http://www.itu.int/wsis/docs/geneva/official/poa.html

[16] Tunis Commitment, November 2005, available at: http://www.itu.int/wsis/docs2/tunis/off/7.html

[17] Tunis Agenda for the Information Society, November 2005, available at: http://www.itu.int/wsis/docs2/tunis/off/6rev1.html

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2.1.3 World Education Forum

At the World Education Forum held in April 2000 in Dakar, Senegal,?more than?180 countries adopted a Framework for Action, comprising six “Education for All” (EFA) goals:[18]

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1) Expand and improve comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children.
2) Ensure that by 2015 all children, especially girls, children in difficult circumstances, and chilren from ethnic minorities have access to and complete free and compulsory primary education of good quality.
3) Ensure that the learning needs of all young people are met through equitable access to appropriate learning and life skills programs.
4) Achieve a 50 per cent improvement in levels of adult literacy by 2015, especially for women, as well as equitable access to basic and continuing education for adults.
5) Eliminate gender disparities in primary and secondary education by 2005, and achieve gender equality by 2015 - with a special focus on ensuring full and equal access for girls to basic education of good quality.
6) Improve all aspects of the quality of education to achieve recognized and measurable learning outcomes for all -especially in literacy, numeracy, and essential life skills.

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The EFA goals are monitored on an annual basis by UNESCO.[19] A mid-term monitoring report published in 2007 found that with regard to?Goal 5, disparities had been reduced, and about a third of countries with available data had achieved gender parity.? The Framework sees ICTs as some of the main tools for achieving these goals:

71. Information and communication technologies (ICTs) must be harnessed to support EFA goals at an affordable cost.? These technologies have great potential for knowledge dissemination, effective learning, and the development of more efficient education services.

72. The swiftness of ICT developments, their increasing spread and availability, the nature of their content and their declining prices are having major implications for learning.? They may tend to increase disparities, weaken social bonds and threaten cultural cohesion.? Governments will therefore need to establish clearer policies in regard to science and technology, and undertake critical assessments of ICT experiences and options.? These should include their resource implications in relation to the provision of basic education, emphasising choices that bridge the 'digital divide', increase access and quality, and reduce inequity.

73. There is need to tap the potential of ICTs to enhance data collection and analysis, and to strengthen management systems, from central ministries through sub-national levels to the school; to improve access to education by remote and disadvantaged communities; to support initial and continuing professional development of teachers; and to provide opportunities to communicate across classrooms and cultures.

[18] http://www.unesco.org/education/efa/wef_2000/press_releases/dak_04_28_19h40.shtml

[19] UNESCO, “EFA Global Monitoring Report” at http://www.unesco.org/en/efareport

2.2 Regional initiatives

Some initiatives to acheive school connectivity are international, but not?necessarily global.? These initiatvies are often regional, combining the resources?of a group of countries?with common interests in promoting educational and ICT gains.? Some of these regional initiatives?have been pioneered by: (1) the Latin American and Caribbean (LAC) countries, (2) the UN Economic Commission for Latin America and the Caribbean (ECLAC),? (3) the New Partnership for Africa's?Development (NEPAD),?and (4) the European Union.?

2.2.1 Latin American and Caribbean Countries (LAC)

Around the world, several regional initiatives have been initiated to promote school connectivity.? Some have evolved from?international initiatives?such as WSIS and the Millenium Development Goals (MDGs).

In 2005, the Latin American and Caribbean (LAC) countries signed the Rio de Janeiro Commitment,?which determined that ICTs should be used to achieve the MDG goals in that region.? It also renewed the region's commitment to expanding cooperation among all countries through the exchange of experience, knowledge, and technology.? The Commitment called for?development of?"e-applications" and?"e-education" solutions.? In addition, it?emphasized the need to create government programmes to provide indigenous peoples with access to ICTs, taking into account the special situation of these groups.[20?]

In 2008, as a consequence of WSIS 2005 and to follow up on the Rio de Janeiro Commitment, LAC countries signed the San Salvador Commitment,?further cementing the region's commitment to using ICTs as instruments to support economic development and social inclusion.? The San Salvador Commitment, which is currently being implemented, called for increasing efforts to achieve the region's priorities in education.[21]? It also reiterated the need to include all stakeholders -- the private sector, civil society, and scientific and academic communities -- in the creation of the?Information Society, as well as in?seeking financial mechanisms?to help?realize the region's ICT goals and targets.[22]

[20]Rio de Janeiro Commitment, Regional Preparatory Ministerial Conference of Latin America and the Caribbean for the Second Phase of the World Summit on the Information Society, June 2005.?
[21]San Salvador Commitment, Second Ministerial Conference on the Information Society in Latin America and the Caribbean, February 2008.
[22]San Salvador Commitment, Second Ministerial Conference on the Information Society in Latin America and the Caribbean, February 2008.

2.2.2 United Nations Economic Commission for Latin America and the Caribbean (ECLAC)

The United Nations Economic Commission for Latin America and the Caribbean (ECLAC) supports the Strategy for the Information Society in Latin America and the Caribbean ("eLAC").??A long-term vision aligned with the MDGs and the goals of WSIS (Figure 2-1), eLAC provides short-term action plans with qualitative and quantitative goals.? These plans, which comprise?the region's Plan of Action for the Information Society, have served to promote integration and cooperation in the area of ICTs, and also have acted as a link between international-level goals and the needs and priorities of the region and its countries.[23]

In 2005, eLAC 2007, the regional plan of action for the 2005-2007 period, outlined 30 goals and 70 activities divided into five "cluster" areas:

(1) Access and digital inclusion,

(2)?Capacity building and knowledge creation,

(3)?Public transparency and efficiency,

(4)?Policy instruments, and

?(5) Enabling environment.

The access and digital inclusion cluster established goals and activities for online schools and libraries, including an objective?to:

> *?"Double the number of public schools and libraries that are connected to the Internet, or connect one third of them, if possible via broadband, particularly those located in rural, isolated or marginal areas…"*[24]

This goal was supposed to be achieved by mid-2007 but remained unfulfilled in most countries.??The *Monitoring eLAC 2007 Report* shed light on the state of progress in the region in terms of the spread of ICTs, according to the goals and activities established in eLAC 2007.? The report pointed out that there had been significant progress in the region in developing?"information societies" in each country.? Fifteen?out of the 27 monitored action areas showed acceptable?or strong growth.? The

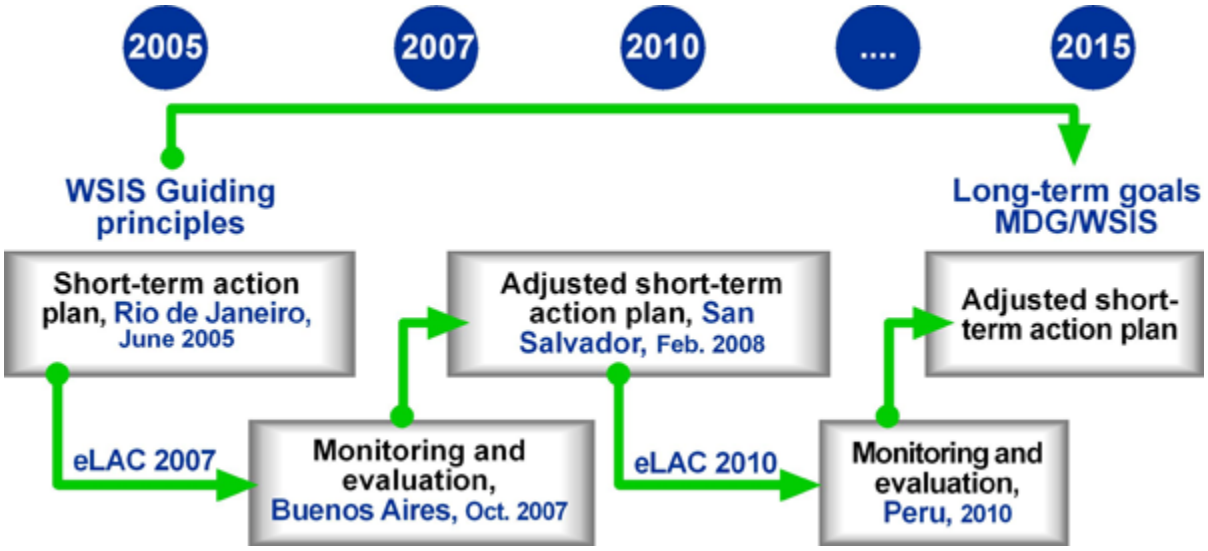
remaining 12 action areas showed moderate to insufficient advances.? Areas of action in which progress was strong and notable were:?

- Digital access and inclusion in community centres and local government;
- Capacity-building and knowledge creation in research and education networks;
- Governmental transparency and efficiency in e-Government and e-Education;
- The development of indicators and measurement as policy instruments; and
- Monitoring of WSIS and the execution of eLAC2007.[25]

The most recent regional plan of action, eLAC 2010, delineated the ICT goals and targets for the region between 2008 and 2010.? It provided 83 goal-oriented activities for six priority areas in the region:? (1) education and training, (2) infrastructure and access, (3) health, (4) public administration and e-government, (5) productive sector, and (6) policy instruments and strategic tools.? With education as a top priority for the region, the eLAC 2010 plan established specific goals and activities for achieving better accessibility and capacity levels in the region, including a goal to:

> *Connect 70% of public educational institutions to the Internet, preferably via broadband connections, or triple the current number.*[26]

Figure 2-1:? The Link between eLAC and International Initiatives



Source: ECLAC.

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[23]eLAC – Strategy for the Information Society in Latin America and the Caribbean, available at: http://www.eclac.org/socinfo/elac/default.asp?idioma=IN

[24]Plan of Action for the Information Society in Latin America and the Caribbean eLAC 2007, http://www.eclac.org/cgi-bin/getProd.asp?xml=/socinfo/noticias/documentosdetrabajo/5/21685/P21685.xml&xsl=/socinfo/tpl-i/p38f.xsl&base=/socinfo/tpl/top-bottom.xsl.

[25]eLAC – Monitoring, available at: http://www.eclac.org/cgi-bin/getprod.asp?xml=/socinfo/noticias/paginas/7/32567/P32567.xml&xsl=/socinfo/tpl/p18f.xsl&base=/socinfo/tpl/top-bottom.xsl

[26]"San Salvador Commitment," in Second Ministerial Conference on the Information Society in Latin America and the Caribbean, LC/R.2144, (San Salvador, 2008) http://www.eclac.org/socinfo/elac/default.asp?idioma=IN?

2.2.3 New Partnership for Africa's Development (NEPAD)

The New Partnership for Africa's Development (NEPAD) announced its "e-Schools Initiative"?in 2003, during the?Africa Summit of the World Economic Forum.[27] The?initiative was adopted as a priority regional activity to ensure that primary and secondary students in Africa have the skills enabling them to participate effectively in the global information society.? One of the components of the project is?infrastructure, and there is a goal to?provide all African primary and secondary schools with Internet connections.

[27]NEPAD e-Africa Commission, "NEPAD e-schools Initiative.? Available at?http://www.eafricacommission.org/projects/127/nepad-e-schools-initiative#1.

2.2.4 European Union

School connectivity initiatives in the European Union (EU) precede those at the international level.? This is not surprising, given that the EU is a developed region and connectivity in some schools has been available since the launch of the Internet.

Nevertheless, the EU has felt it to be important to reiterate its commitment to the information society.? So, the European Commission (EC) launched the eEurope initiative in 2000 with the aim of accelerating Europe's transition towards a knowledge-based economy and to realise the potential

benefits of higher growth, more jobs and better access for all citizens to online?services.? The Europe Action Plan was published, establishing a?priority?for

> *Member States [to] ensure that all schools in the Union have access to the Internet and multimedia resources by the end of 2001.*[28]

This goal was primarily aimed at a few Member States that had been?lagging behind in school connectivity.? By March 2002, school connectivity in the EU rose?4 per cent over the preceding year, to 93 percent (See?Figure 2-2).

The eEurope 2002 Action Plan focused on exploiting the advantages offered by the Internet and?increasing connectivity.? The achievements of that plan?were summarized in a Final Report, which was presented by the EC in February 2003.[29] ?eEurope 2002 was very successful in extending Internet connectivity, but?effective usage of the Internet was not developing as fast as connectivity.??Subsequent policy attention shifted to supporting use of ICTs through an increased availability of high-quality infrastructure, as well as availability of attractive services and applications and the encouragement of organisational change.

?The eEurope 2005 Action Plan,[30] for example, focused on exploiting broadband technologies to deliver online services in both the public and private sectors.? ?eEurope 2005 also promoted high-speed (broadband) connectivity to stimulate the use of the Internet for more developed applications and services.? Finally, the 2005 plan?also attempted to make the benefits of the Information Society available to the socially excluded and people with special needs.

The eEurope initiative concluded at?the end of 2005 but was?followed by the i2010 initiative.? Within the context of the i2010 initiative, The European Commission is promoting "eAccessibility" aimed at ensuring that people with disabilities and elderly people can access ICTs on an equal basis with others.

Figure 2-2: Internet in schools (% of schools connected by internet access type and type of locality), European Union

Country	Total	Narrowband Internet access schools	Broadband internet access schools	Schools in densely populated areas	Schools in intermediate areas	Schools in thinly populated areas
BE	96.9	100.0	100.0	97.5	96.2*)	96.2*)
CZ	99.2	100.0	100.0	100.0	98.5	99.1
DK	99.2	100.0	100.0	100.0	98.4	99.3
DE	97.5	100.0	100.0	97.5	97.5	97.5
EE	98.1	100.0	100.0	93.9*)	93.9*)	99.7
EL	96.6	100.0	100.0	98.6	100.0	92.9
ES	94.7	100.0	100.0	93.0	95.7	96.9
FR	90.3	100.0	100.0	84.9	91.4	92.8
IE	98.4	100.0	100.0	100*)	100*)	98.1
IT	97.8	100.0	100.0	96.9	98.0	98.9
CY	95.0	100.0	100.0	90.3	100*)	100*)
LV	94.3	100.0	100.0	94.7*)	94.7*)	94.1
LT	94.5	100.0	100.0	91.1	N/A	95.7
LU	95.5	100.0	100.0	95.4*)	95.4*)	95.4*)
HU	96.1	100.0	100.0	96.0	100.0	94.7
MT	100.0	100.0	100.0	100*)	100*)	100*)
NL	100.0	100.0	100.0	100.0	100.0	100.0
AT	99.2	100.0	100.0	98.9	100.0	98.7
PL	92.7	100.0	100.0	97.0	92.2	89.6
PT	92.1	100.0	100.0	100.0	98.5	99.1
SI	99.8	100.0	100.0	98.9	100.0	100.0
SK	97.5	100.0	100.0	98.7	98.6	97.4
FI	99.7	100.0	100.0	100*)	100*)	99.6
SE	99.9	100.0	100.0	99.7*)	99.7*)	100.0
UK	99.8	100.0	100.0	100.0	99.5	100.0
IS	99.5	100.0	100.0	N/A	98.7	100.0
NO	99.8	100.0	100.0	100.0	100.0	99.7
EU25	96.2	100.0	100.0	96.0	96.5	96.1
EU25+2	96.2	100.0	100.0	96.0	96.5	96.2
EU15	96.5	100.0	100.0	95.9	96.9	96.8
NMS10	94.7	100.0	100.0	96.8	94.6	93.5

Base: All schools of the respective breakdown category and country.
Question: Q9
Wording: Q9: By which of the following means does your school mainly have access to the internet: ...
Indicator: % of schools stating at least one type of internet connection.
Source: empirica: LearnInd 2006 (HTS)

xx.x%: based on at least 50 cases.
xx.x%: based on at least 10 cases.
xx.x%: based on less than 10 cases

An EU-wide Survey, published by the European Commission in September 2006, showed that by that year, 96 per cent of all schools in Europe had internet access, and 67 per cent already had a broadband connection.??Broadband take-up still varied widely in Europe, however, from about 90 per cent of schools in Scandinavian countries (and?in the Netherlands, Estonia and Malta) to less than?35 per cent in Greece, Poland, Cyprus, and Lithuania.? The study found no major differences in internet connectivity between schools in less densely populated areas and those in urban areas.??The study also showed that?broadband connectivity in schools tended to follow national broadband penetration rates, with the exception of Estonia, Malta, Slovenia and Spain, where the penetration of broadband in schools was?much higher than the overall level achieved in these countries.[31]

?

[28]http://www.ictdevlibrary.org/downloads/02_ec_e-europe_action_plan_obj_2.pdf

[29]Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions - *eEurope 2002 Final Report* (COM 2003 (066) Final),? available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2003:0066:FIN:EN:PDF

[30]Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions - *eEurope 2005: An information society for all - An Action Plan to be presented in view of the Sevilla European Council, 21/22 June 2002*, (COM 2002 (263) Final), available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2002:0263:FIN:EN:PDF

[31]Commission Survey : "Benchmarking Access and Use of ICT in European Schools 2006," available at: http://ec.europa.eu/information_society/eeurope/i2010/docs/studies/final_report_3.pdf

2.3 National initiatives

?Several?countries have adopted national strategies, policies and targets for school connectivity, often reflecting international and regional initiatives.? These national initiatives?are important in?building?a national consensus to establish Internet connectivity.?

One of the priorities of Chile's Digital Strategy for 2007-2012, for example,?is to increase the intensity and depth?of students' ICT usage.? The goal is not only to establish school connectivity, but to?ensure that the infrastructure is robust and high-quality enough to?support the educational process.? To achieve these goals, Chile's Digital Strategy aims to?double the number of?broadband connections, covering the?entire country during the 2007-2012 period.[32]? According to the *Digital Development Indicators Report* published in early 2009, there were 6,835 school facilities connected to the Internet at the end of 2008, and there were 24 students per computer.[33]

In Peru, the *General Policy Guidelines to Promote the Wide-Ranging Access to the Internet in Peru* was?issued by presidential decree in 2001.? The decree created a multi-sector commission to formulate a national action plan and also set forth general policies to be integrated into individual?sectors' action plans.? With regard school connectivity, the guidelines directed?the Ministry of Education?to submit annual plans for?providing Internet access in schools.[34]?

Colombia has established Compartel, a program financed through?the Fund for Information Technologies and Communication.? Compartel has invested USD 365.7 million to?provide broadband Internet connectivity to public institutions and?community access centres throughout the country.? To date, these investments have benefitted 20,656 public institutions, of which 13,691 are?educational organizations.? This has been complemented by the *Computadores para Educar* programme, which

has also invested USD 103.8 million,?benefitting close to 14,400 public schools (32.25 per cent of all?public schools) and making more than 200,000 computers available.[35] The Ministry of Information Technologies and Communications in Colombia has estimated?that almost 4.8 million children and 172,000 teachers can use ICTs in the classroom.

[32] *Estrategia Digital Chile 2007-2012, Capitulo 2: Objetivos y Metas*, available at: http://www.estrategiadigital.gob.cl/node/122

[33] *TIC en la Educacion, Indicadores de Desarrollo Digital en Chile, Estrategia Digital del Gobierno de Chile*, available at: http://www.estrategiadigital.gob.cl/files/2009-09-03%20-%20Indicadores%20de%20Desarrollo%20Digital.pdf

[34] *Decreto Supremo No. 066-2001-PCM, Lineamientos de Politicas Generales para Promover la Masificacion del Acceso a Internet en el Peru, Anexo – Politicas Generales*, available at: http://www.codesi.gob.pe/codesi/docs/nacionales/lineaperu.pdf.

[35] Speech of the Colombian Minister of Information and Communication Technologies, Dra. María del Rosario Guerra to the 2010 ITU Development Conference Regional Preparatory Conference for the Americas, held in Santa Marta, Colombia, from 9 to 11 September, 2009, available at: http://www.itu.int/ITU-D/conferences/rpm/2009/ams/documents/OpeningStatement_Minister-es.html

3 Key Elements for plans to connect schools

There are multiple?strategies to connect schools, and, on a?micro level,?multiple?ways to?identify and select candidate schools?and networking options.? There are also?varous regulatory tools that governments can implement to foster school connectivity.? In addition,?different funding mechanisms can utilized by countries to carry out school connectivity.? Lastly, there is a?need for countries to include monitoring and evaluation as part of their school connectivity plans.??Several best practices can be combined in a?School Connectivity Checklist.

3.1 School connectivity plans

A growing number of countries are elaborating "ICT for education" (ICT4E) policies (Table 3.1).? Policy goals regarding digital inclusion need to be translated into a practical plan and concrete action points for connecting schools.? Developing a plan is critical to bring a strategy from the conceptual stage to the practical level.? A plan should address how to?identify the schools that will be connected,?funding sources, technologies to be used, and how the connectivity will be sustained.? A plan also can align education sector targets with national ICT goals.? And it can?promote?mechanisms to involve all?key stakeholders. ?

Table 3-1: ?ICT4E Policies

Country	ICT for Education Policy	Source ?	School connectivity goal [Timetable]
Bolivia	National Policy for New Information and Communication Technologies for Schools (2005)	Ministry of Education	Develop the infrastructure that will permit establishing a connection to access ICTs in all of the national territory, supplying schools, institutions and teacher training centres, technical schools and universities. [The policy lays out general guidelines but does not specify a timetable for

Country	ICT for Education Policy	Source ?	School connectivity goal [Timetable]
			accomplishing the goals] ?
Cambodia	Policies and Strategies on Information and Communication Technology for Education in Cambodia (2004) ?	Ministry of Education, Youth and Sport ?	Provide access to ICTs for all teachers and students, especially at the secondary level, ensuring that ICTs?are used as an enabler to reduce the digital gap between Cambodian schools and other schools in neighboring countries. [2004-2010]
Namibia	ICT Policy for Education (2005)	Minister of Higher Education, Training and Employment Creation; Minister of Basic Education, Sport	All educational sites are to be connected [Does not propose specific dates but notes: “Any realistic Government strategy for ICT for education will consist of mainly small and low-key initiatives that, if consistently sustained, will lead to comprehensive progress over a 5-10 year period.] ?

?

3.1.1 Need for plans

School connectivity plans cannot stand alone.??In order to be effective, they?must be consistent with policies to promote country-wide ICT connectivity.? Within a national framework, school connectivity plans need to be coordinated with policies, plans, strategies, and programs for universal service, as well as?broadband and?Information Society agendas.? In the education sector, school connectivity plans need to complement?policies and plans that already may be in place to extend educational services to all population groups. ?

School connectivity strategies can be incorporated into?more general education master plans.? However, those broad education plans are?unlikely?to ?provide sufficient focus on the revolutionary impact that ICT use?can have on?learning,?curriculum development,?teacher training and infrastructural changes to the school environment.? Furthermore, education master plans tend to be developed infrequently, whereas ICT is a rapidly evolving area.? A specific e-education plan will ensure that proper focus and detail is devoted to school connectivity and that implementation targets are feasible and fundable.?

A detailed ICT-for-education strategy is also essential to facilitate funding from development partners.? For example, in Botswana, school connectivity is addressed in the national 2007 ICT Policy, which calls for all schools to be connected to the Internet by 2010.[36]? However, the Policy does not provide the necessary implementation details, nor does it?specify how school connectivity fits into the overall educational philosophy.? As a result, implementation has lagged behind, with few schools getting connected.[37]

[36]http://www.ub.bw/ip/documents/2007_National%20Information%20and%20Communications%20Technology%20Policy.pdf
[37]http://www.mmegi.bw/index.php?sid=1&aid=51&dir=2007/August/Wednesday15

3.1.2 Stakeholders

In addition to the Ministry of Education,?other government agencies have an interest in school connectivity.? These other stakeholders should be incorporated into school connectivity plans to ensure coordination and consensus on strategies.?

Stakeholders can include government leaders that have called for the policy, as well as government agencies such as the ministry responsible for ICTs, the ICT regulator, the national planning agency or the entity responsible for the management of the Universal Service Fund.? In countries with a decentralized educational system, local governments also have a strong interest in school connectivity.?

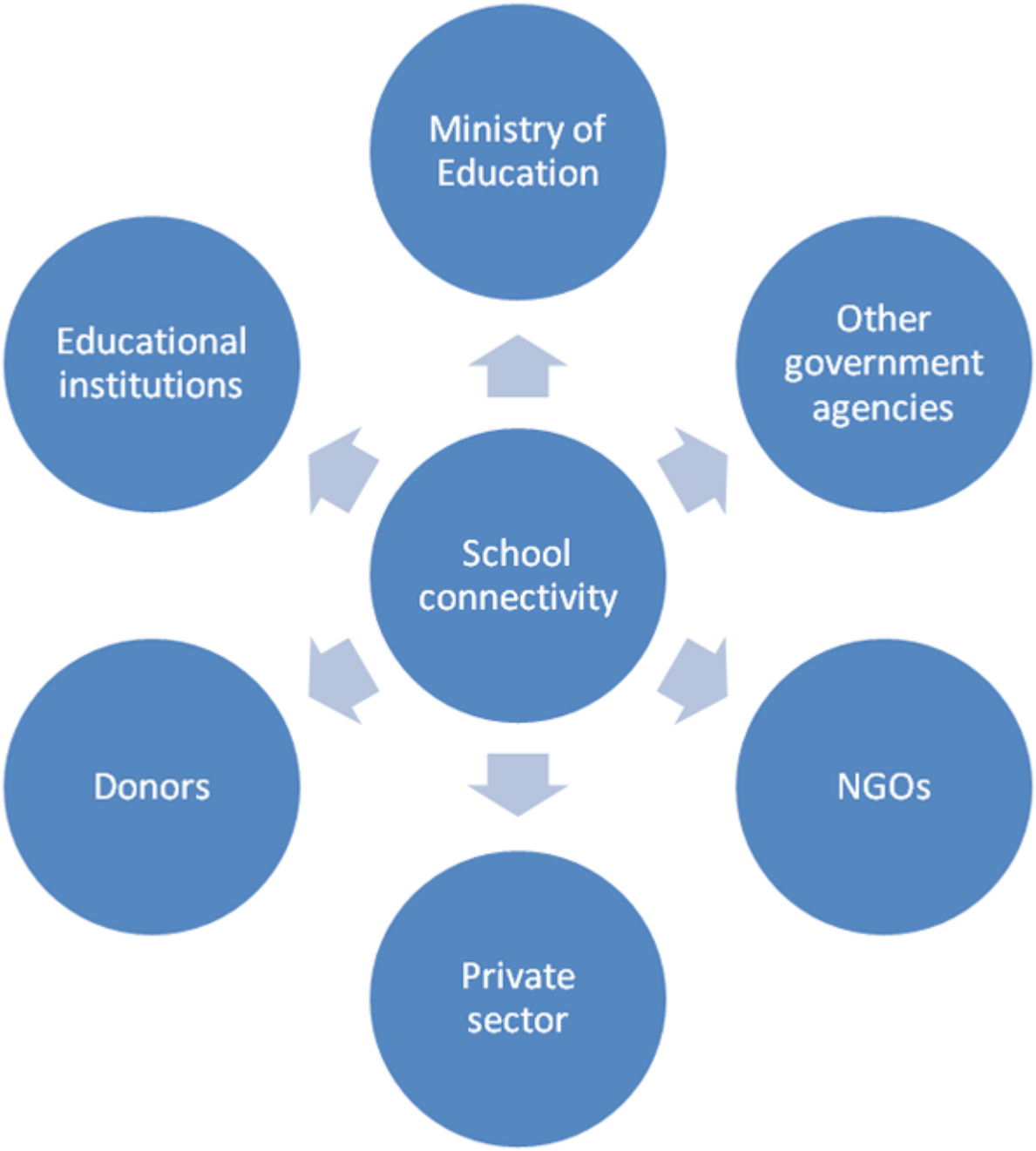
Beyond the governmental actors, the private sector and non-governmental organizations (NGOs) can play key roles in advancing school connectivity.??Their participation should also be taken into consideration when developing school connectivity plans.? The private sector -- particularly service

providers and equipment vendors -- are likely to be engaged in the planning, deployment and operation of projects to expand connectivity, regardless of the project structure or funding process.? NGOs, meanwhile, are playing leading roles in many countries by implementing projects to expand ICT access in schools.? NGOs can provide valuable information to policymakers about?what has and has not worked in their experience and potential challenges in replicating or expanding the scale of their programs.?

Countries also need to take into consideration the interests and needs of the end users.? In addition to school officials, end-user interests also include students and their families, as well as representatives of specific groups that?may have special requirements, such as women and girls, indigenous peoples and persons with disabilities.

The participation and contribution of all these key stakeholders can make school connectivity plans more effective and sustainable.? It also can?increase support from constituent groups that feel they have had a meaningful impact on policy development.

Figure 3-1:? Stakeholders in School Connectivity



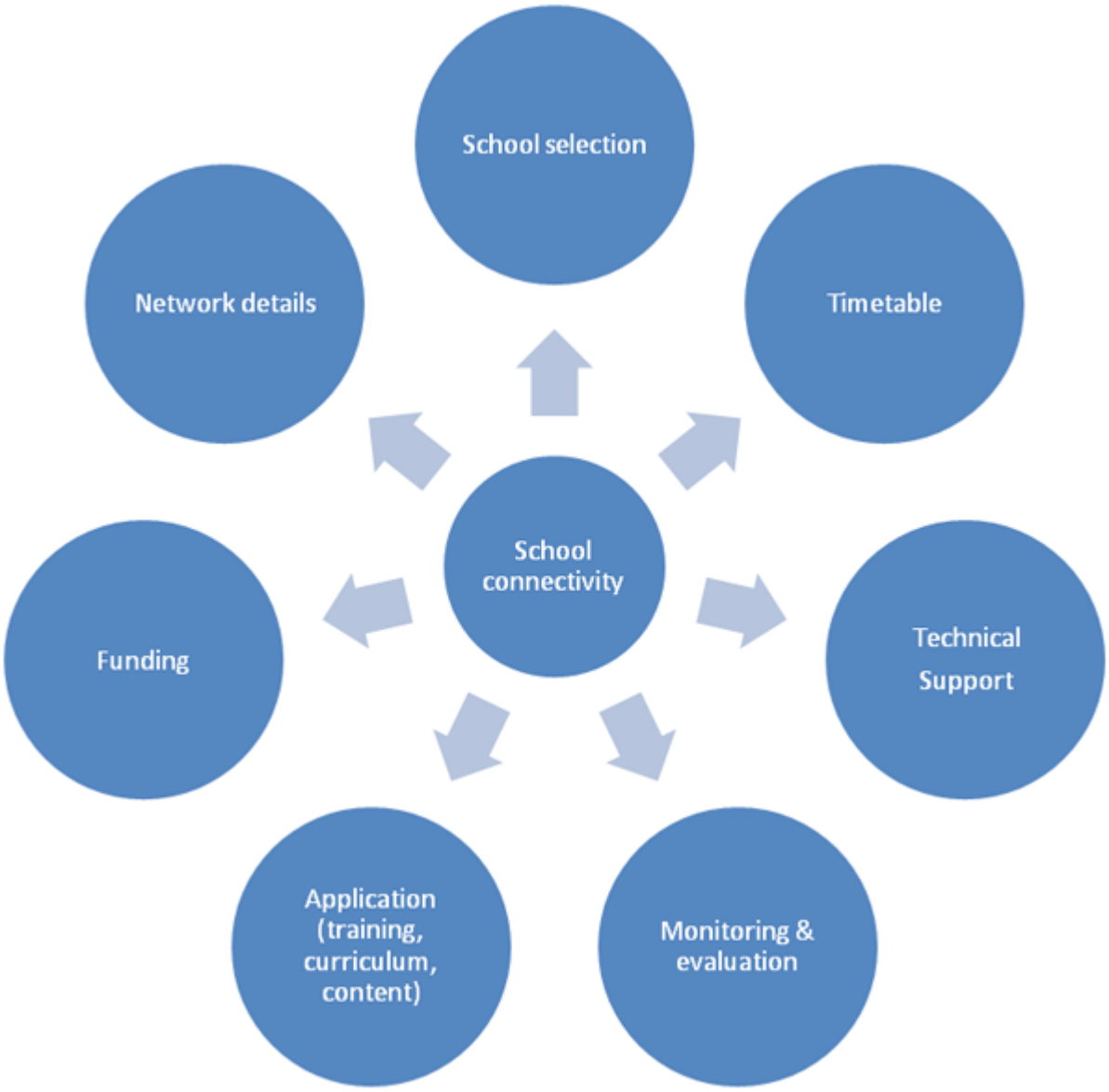
3.1.3 Elements of a plan

While no two countries will develop their connectivity plans in the same manner, it is crucial to implement some kindo of?defined process.? The ultimate plan may differ from that envisioned at the outset of the process, but ideally the changes will reflect the beneficiaries' needs, the resources available from government and other sources, and the potential of the technologies to be employed.

While processes will vary, there are common elements.? When developing a plan for school connectivity a country needs to determine certain key parameters by which the plan's connectivity goals and targets will be guided and carried out.? Each country has a different set of needs, but countries that have implemented school connectivity projects have considered the following key elements:

- Evaluation of relevant policies, laws and regulations, including identification of policies and programs that will help or hinder broadband connectivity efforts;
- Identification of targets and milestones, including bandwidth and deployment timelines, based on current and expected future technologies and applications;
- A network model to determine, for example,?if a centralized education network is preferable to subsidization of direct connections to private ISPs;
- Identification of?funding sources and levels, including long-term plans for sustainability;
- Coordination and?implementation, including determining which government entities will be involved in implementing the plan;
- Determination of?whether school connectivity will be centralized and coordinated at a national level or whether it will be decentralized, with coordination taking place at different levels (national, regional and/or local) ;
- Identification of appropriate end-user equipment or minimum specifications for such equipment;
- Identification of cross-cutting issues such as teacher training, child online protection, accessibility for persons with disabilities, etc.; and
- Definition of appropriate legal and regulatory frameworks for cyber-security, on-line protection of minors, and privacy, and incorporation of such frameworks into school connectivity projects

Figure 3-2: Key Considerations for School Connectivity



3.2 Which schools to connect

Very few developing countries have the financial, technical, personnel or logistical resources to quickly connect all schools to the Internet -- although in at least one case (Macedonia) it has been done in less than a year (see case study on Macedonia).? If?all schools are eventually to be?provided with Internet access through a *top-down* process, coordinated by the Ministry of Education, then priorities need to set?about which schools should be covered first by the connectivity plan.

In some countries, there is no plan or, even if one exists, implementation is slow or blocked because of a lack of government funding.? In those cases, there may be *bottom-up* initiatives, driven by NGOs or

schools themselves, for connecting educational institutions.? Another possibility is a *hybrid* approach where there are national connectivity programs funded by the government but schools have to apply for funding.

Table 3-2:? Approaches to Selecting Schools for Connectivity

APPROACH	ADVANTAGES	DISADVANTAGES
Top-Down Centralized agency identifies schools to be connected (e.g., primary, secondary, tertiary; public, private; urban, rural)	• Guarantees uniformity in provision of connectivity • May provide capacity training and support to teachers? • Offers economies of scale –?the government?can establish attractive agreements with service providers for connectivity, equipment, service fees maintenance, support, etc. • May help to prioritize which schools should receive connectivity	• Lack of direct contact between recipient schools and centralized agency may lead to gap in views of connectivity needs or goals • Too much uniformity can create a one-size-fits-all approach and a mismatch between funding and needs • Lack of a central plan or complacency by Ministry of Education may delay school connectivity • Can create a lack of transparency in school deployment process

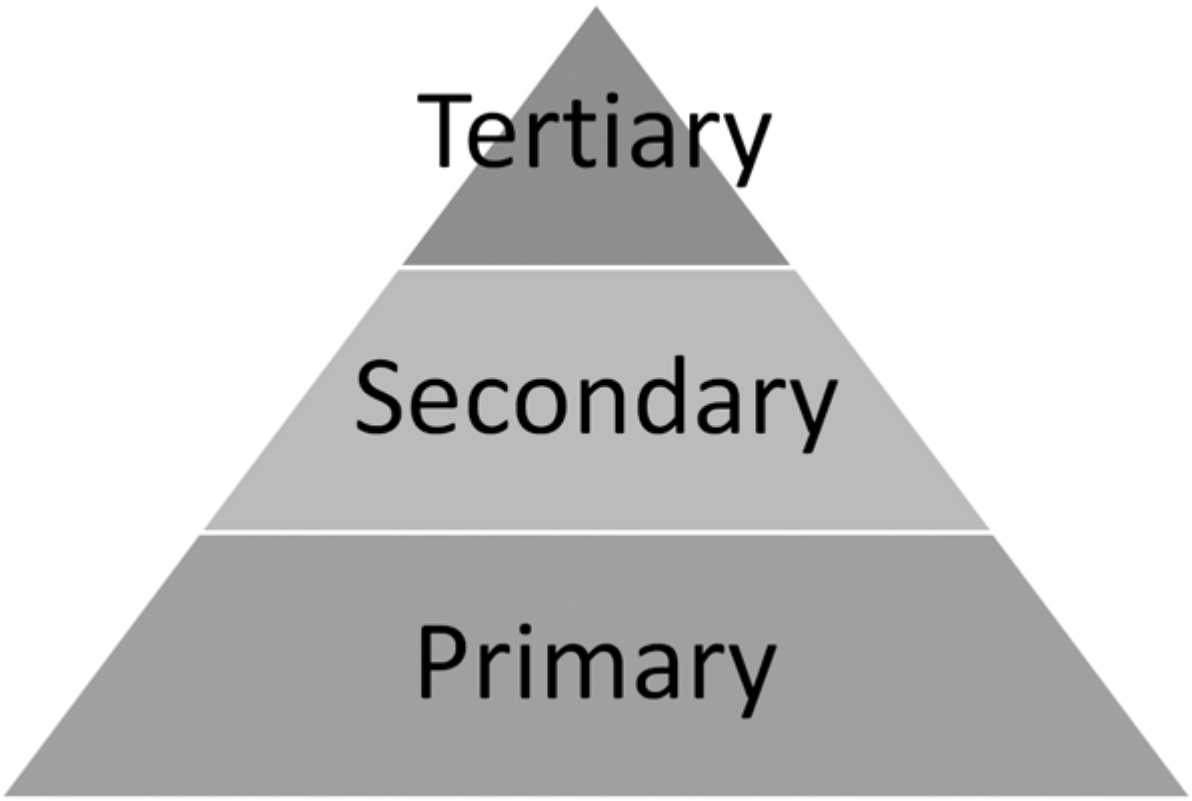
APPROACH	ADVANTAGES	DISADVANTAGES
Hybrid Centralized agency decides on national specifications for connectivity but individual schools must apply	• Involves schools in implementation of connectivity and usage of ICTs in education • Provides guidance and consistency on technical solutions • Makes schools focus on specific needs and how to meet those needs • Can ensure funds are available • School selection more transparent	• Local schools may not have a sufficient understanding of the benefits of Internet access and use of ICTs in education • Local schools may lack personnel qualified to manage new technologies • Schools may not be aware of the availability of funds for connectivity • Schools that do not meet requirements remain unconnected
Bottom-Up Schools arrange for their own connectivity through their own funds or funds offered to them by private sector or NGOs	• Schools that have resources can implement connectivity without delay • Schools can select solutions that are appropriate to their circumstances • Some development partners are willing to fund smaller pilot projects rather than large-scale programs	• Schools?do not benefit from economies of scale • Integration of local connectivity solutions into eventual government-wide plan becomes more complex

APPROACH	ADVANTAGES	DISADVANTAGES
		• Long-term sustainability uncertain

Governments need to decide which educational levels (e.g., primary, secondary, tertiary) the connectivity plan will target. ?The number of schools and students in most countries resembles a pyramid structure, with tertiary institutions having fewer students,?followed by secondary schools and then primary schools.

Most countries have initially focused on secondary schools. One reason is that tertiary institutions (i.e., colleges and universities) are often administered differently and have their own plans and priorities.? Another is that universities in most countries generally already have Internet connectivity.? In terms of primary and secondary schools, the number of institutions is a key factor. Since there are fewer secondary schools than primary schools, it is more cost-effective to provide connectivity to the former. ?It is also felt that secondary students, being older, will benefit more from having Internet connectivity and are closer to entering the workforce, which increasingly requires ICT skills.? This is not to say that primary schools should be ignored, but rather sequenced for later connectivity.

Figure 3-3: Size Relationship among School Levels



?Countries also need to decide the type and locations of schools to be connected.? In terms of *public* (i.e., government owned) or *private* schools, the former are almost always a priority, given that planning and funding is from the Ministry of Education, whose main focus is on the public school system.? It is also assumed that private schools have greater resources to fund their own connectivity.

While it may be socially desirable to connect *rural* or remote schools, in some countries providing access to large *urban* schools will have an initial greater benefit by covering more students at a lower cost.? For example, in Argentina, Chile and Uruguay, less than 15?per cent of primary school students live in rural areas. ?On the other hand, in countries such as India, the Philippines and Sri Lanka, more than?half of all pupils?do.?

Table 3-3: Distribution of Primary Students by School Location, 2008?

TABLE A2.1 DISTRIBUTION OF PRIMARY PUPILS BY SCHOOL LOCATION

	Type of community											
	Village (<3,000 inhabitants)		Small town (3,000-15,000 inhabitants)		Town (15,001-100,000 inhabitants)		City (100,001-1,000,000 inhabitants)		City centre (>1,000,000 inhabitants)		Elsewhere in a city	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Argentina	12.3	0.95	21.0	1.59	29.5	1.68	27.7	1.71	6.3	0.83	3.1	0.62
Brazil	23.3	1.80	19.5	1.87	24.4	2.10	20.4	2.02	6.0	1.19	6.3	1.19
Chile	10.4	0.97	9.5	1.42	17.1	1.74	42.8	2.17	13.1	1.51	7.3	1.12
India	58.6	3.00	19.0	1.88	9.7	1.62	6.7	1.14	3.5	1.01	2.5	1.01
Malaysia	36.8	2.21	30.7	2.79	16.5	1.89	12.0	1.65	3.7	1.10	0.3	0.17
Paraguay	42.8	1.28	27.3	1.55	10.2	1.09	10.3	1.00	8.1	0.93	1.3	0.44
Peru	38.4	1.51	12.3	1.51	13.1	1.60	11.7	1.46	6.7	1.27	17.8	1.76
Philippines	55.6	2.22	14.8	1.87	13.1	1.79	8.8	1.48	6.0	2.42	1.8	0.58
Sri Lanka	54.5	2.04	21.8	2.24	12.7	1.87	6.9	1.66	2.7	1.05	1.5	0.82
Tunisia	38.9	1.61	21.0	1.95	27.3	2.07	7.7	1.32	1.5	0.57	3.7	1.07
Uruguay	14.8	1.27	18.2	1.46	28.7	1.71	3.9	0.78	0.4	0.23	34.1	0.61
WEI-SPS median	**38.4**		**19.5**		**16.5**		**10.3**		**6.0**		**3.1**	

Source: WEI-SPS database.

Source: UNESCO Institute for Statistics, *A View Inside Primary Schools: A World Economic Indicators (WEI) cross-national study, 2008*

In Namibia, schools to be connected to SchoolNet, a non-profit organization providing sustainable Internet access to schools, are selected based on a number of factors and scored based on a point system.? Factors include the school level, whether there is access to electricity and telecommunications, teacher to student ratios, and distance from the nearest town.[38]? Schools are allotted points based on these factors, and the point totals are used to identify the highest-priority schools.

Figure 3-4: SchoolNet Selection Criteria, Namibia

Prioritising the schools

A key question is to ensure that disadvantaged schools get priority access to SchoolNet services. To aid in decision-making, schools were ranked on a point system adapted from the rural electricity distribution master plan for Namibia. Schools that score high will be supported first.

Senior secondary school (11–12)	70
Junior secondary school (8–10)	65
Combined school (mainly secondary)	60
Combined school (mainly primary)	55
Senior primary school (5–7)	50
Junior primary school (1–4)	45
Cluster centre status	100
Hostel at school	60
Per learner	1
Per teacher	2
ratio learner: teacher >40:1	15
ratio learner: teacher range 30:1 to 40:1	10
ratio learner: teacher < 30:1	5
no telecommunication	15
no electricity	15
remoteness > 30 km from town	20
remoteness > 20 km from town	10
remoteness > 10 km from town	5

Source: Swedish International Development Cooperation Agency (Sida)

Schools serving specific groups, or in particular locations, have been targeted for special school connectivity programs in some countries.? In Canada, the *First Nations*[39]*SchoolNet* program provides Internet access, computer equipment and technical support to schools on reserves for aboriginal peoples throughout Canada, particularly those schools not yet connected to the Internet.[40] In Chile, where the majority of students are in private schools or schools funded by municipalities, the country's *Enlaces* program targets school connectivity for federally subsidized public schools.

An inventory of school infrastructure will help?determine the potential for connectivity, as well as the need for different connectivity models that fit different schools'?circumstances and needs.? The inventory?includes identifying which schools already have Internet access, and whether that access

could be improved.? The Ministry of Education, after all, may not be aware of schools that have been connected through local or NGO initiatives.??

The inventory?also can include identifying which schools have supportive infrastructure, such as telephone lines and electricity.? Schools might then be classified by their potential for connectivity and the type of connectivity to be made available according to their infrastructural capacity.? Pakistan has proposed the following categorization:

> *"The TIU [Technical Implementation Unit] will establish categories ranging from "no infrastructure" for technology in some rural areas, to "high-level" infrastructure in many urban schools. Thousands of non-electrified, rural primary schools might only be able to use battery-powered devices and fall into a low-technology category. Urban schools might be able to support a laboratory of new computers with high bandwidth Internet connections through a local area network, and thus fall into a high-technology category. Schools will receive ICT "packages" in accordance with the "readiness" category. Ultimately, the goal must be for low-technology schools to move upwards to higher technology categories."*[41]

[38] SIDA, *Evaluation of Swedish Support to SchoolNet Namibia*. (2004).

[39]In Canada, the term First Nations refers to indigenous groups in the country.

[40]First Nations SchoolNet Program, available at: http://www.ainc-inac.gc.ca/edu/ep/index1-eng.asp and http://fnschools.ca/about

[41]http://www.unescobkk.org/uploads/media/NICT_Strategy_For_Education_in_Pakistan_-__Mar_2007.pdf

3.2.1 Setting timetables for implementation

Implementing a national school connectivity plan is often a long-term process.? It is essential for a school connectivity plan to have a timeframe, particularly given the multiple, inter-related variables that need to be taken into consideration.? Those variables include sequencing of schools to be connected, the status of the local Internet network, whether appropriate policies and regulations are in place and?whether funding is available.?? A realistic timetable helps to ensure that implementation goals are feasible and that the project remains on track, particularly if ongoing monitoring and accomplishment milestones are built into the timetable.???

Morocco's *Generalization of ICTs in Learning (GENIE)* program was created in 2005 to enhance the availability of computer labs with Internet connectivity in public schools. The program envisaged a three year deployment timetable.[42]? It is Interesting to note that a review of targets was built into the original program, and a revision of numbers was made two years after the start of the program (See Table 3-4, below).[43]?

Table 3-4: Timetable for Morocco's GENIE Program

?	Target number by type of school and year?						
?	? **Primary**		? **Junior secondary**		**? Secondary**		**?Total**
?	?**%**	**?Number of schools**	?**%**	?**Number of schools**	?**%**	?**Number of schools**	?**Number of schools**
?Year 1	?50%	3,387	?75%	897	? 75%	474	?2,152
?Year 2	?25%	1,694	?25%	299	?25%	159	?2,152
?Year 3	?25%	?1,694	?-	?-	?-	?-	?1,694
?Total	?**100%**	**?6,775**	**?100%**	**?1,196**	?**100%**	**?633**	**?8,604**
?????**?? 104,000 PCs and 17,200 printers in three years.**							

Source: ANRT.

One goal of the *Medium Term Philippine Development Plan* for 2004-2010 was that every public high school in the country should have at least one computer (the level of computerization in high schools at the time the plan was launched was 80 per cent).[44]? The Plan also included a provision for providing about 30 high schools a year with Internet connectivity.? The government decided that Internet connectivity in schools was proceeding too slowly,?so it announced a priority connection program in May 2009. The *Internet Connectivity Project* mandates that all public high schools be connected to the Internet by the end of 2010.[45]

[42]http://www.anrt.ma/fr/admin/download/upload/file_fr1209.pdf

[43]*Moratoire pour une nouvelle stratégie nationale en matière d'intégration des technologies*

d'information et de communication dans l'enseignement (TICE), GENIE portal, available at?:? http://genie.men.gov.ma/Moratoire.htm

[44]Medium Term Philippine Development Plan (MTPDP) 2004-2010, Chapter 18: Education, available at: http://www.neda.gov.ph/ads/mtpdp/MTPDP2004-2010/PDF/MTPDP%202004-2010%20NEDA_Chapterx18_Education.pdf

[45]"Launching the DEPED Internet Connectivity Project and Directing All Public High Schools to Subscribe to Internet Connectivity Services", Order No. 50, Department of Education, Republic of the Philippines, May 2009, available at: http://www.deped.gov.ph/cpanel/uploads/issuanceImg/DO%20No.%2050,%20s.%202009.pdf

3.3 Network details

There are various?networks considerations when connecting schools to the Internet.? One is the selection of broadband technology.? While a narrowband solution, such as dial-up service, will?provide Internet connectivity, access is slow, the service is not "always-on" and costs can be higher than broadband.

Appropriate broadband speeds need to be identified along with the selection of high-speed technology.? Another consideration is whether to provide direct access to the Internet or, instead,?to connect schools through an educational network.? Such networks allow?educational institutions to be linked to each other within a country or region.? Network links can extend potentially to overseas?networks.? The network topology within schools also needs to be established, as does a policy for migration to broadband at?schools that already have narrowband connectivity.

3.3.1 Broadband technology

There are many?benefits to connecting schools with broadband networks.? But few plans to connect schools?actually define what *broadband* means in terms of speed.? It is important for plans to detail broadband specifications, since the connectivity requirements of schools vary tremendously.? A large urban school with many students, for instance,?will need more bandwidth than a small rural school.[46]? At the same time, inadequate bandwidth will inhibit the use of some applications, undercutting the usefulness of the service for educational purposes.

Malaysia found that a bandwidth of 128 kilobits per second (downlink) and /64 kbps (uplink) “was insufficient to support the Smart School Applications Software and communications requirements.”[47] In developed countries, broadband speeds in school connectivity initiatives include:

- Australia:?100 megabits per second (Mbps) for 90 per cent of schools and 12 Mbps for the remainder;[48]

-?Ireland:? 100 Mbps for post-primary schools;[49]

- United Kingdom:??2, 5, 10 or 100 Mbps for schools in London.[50]

It is also important to set broadband?speed guidelines?for?deployment that may be?outsourced to third parties.??Different levels of broadband connectivity may be appropriate for different schools, depending on the schools' size or location.

There are several?technologies?for broadband access.? Availability, appropriateness and cost are the key factors in deciding which method to use for Internet access.? If telephone lines already exist in the school, it may be possible to use digital subscriber line (DSL) service, which can be offered without?additional investment in infrastructure?(other than for a DSL modem).? Other broadband options include coaxial cable or fiber-optic connections, although these?options?may not be available or affordable in?many developing countries.

Broadband wireless technologies such as WiMAX,[51] or third generation mobile or satellite Internet access are possibilities wherever fixed lines are unavailable.[52] Examples of various technologies used around the world to provide Internet access to schools are shown in the table below.

Table 3-5: Internet connectivity technologies

Technology	Comment
Dial-up	Most common narrowband connectivity option; uses?existing telephone?network. Can incur significant costs if telephone usage charges must be paid. ?

Technology	Comment
ISDN	Connectivity provided over telephone line network, generally limited to 128 kbps.? Like dial-up, connection must be initiated and terminated by user; service is not always-on.? Can incur significant costs if telephone line usage charges must be paid. ?
GPRS	Mobile technology using GSM networks providing narrowband access at speeds roughly similar to dial-up. ?
EDGE	A GSM-based technology that can provide theoretical speeds of up to 1 Mbps, depending on the implementation. Actual speeds vary tremendously. Used for Internet connectivity in some Kenyan schools.[53] ?
W-CDMA	A third-generation (3G) mobile technology providing speeds up to 384 kbps. ?
HSDPA	A broadband?3G mobile technology. ?
EV-DO	A?3G mobile cellular broadband technology based on CDMA2000. Being used to connect schools in Guatemala and Indonesia.[54] ?
DSL	Used by schools in a number of countries. Requires telephone line connection. ?
Cable modem	Provides broadband over cable television networks. Not widely deployed in developing countries. ?
Ethernet	Local Area Network (LAN) technology. A wired alternative to Wi-Fi. ?
Fiber optic	Provides very high bandwidth but costs significantly more than other options. Generally used in tertiary institutions and urban schools in developed

Technology	Comment
	countries. ?
Fixed Wireless Access	Provides wireless Internet access using proprietary technology. Macedonia has connected all of its schools using fixed wireless access technology.[55] ?
Wi-Fi (802.11)	Not an Internet access technology but rather a wireless local area connectivity solution for extending the Internet access throughout a school. Wi-Fi mesh networks can be used to distribute resources from computers to computers, reducing reliance on Internet access. ?
WiMAX (802.16)	Used by schools in several countries including Nigeria[56] and the Philippines.[57] ?
VSAT	Satellite technology generally used to provide Internet access to rural schools. Examples include Argentina, Malawi and Thailand.? ?

Countries should take into consideration the state of their?communications networks when they?identify the technology to be used to connect schools.? However, they can also take a technology-neutral approach, allowing?any technology to be used to provide connectivity.? This approach is often preferable, particularly when there are a variety of different school environments and where not all technologies may be available for each school.? This flexibility needs to be weighed against the benefits of obtaining economy of scale and the full support a large project might receive by selecting a particular standard.

[46]"Effective ICT-driven innovation in the classroom requires a basic minimum transmission speed of about 128 kbps per networked computer. This means that schools with about 80 students and up require network access at broadband levels, while schools with smaller populations can rely more on narrowband delivery." Botswana National ICT Plan.

[47]Case Study on? ICT integration into education in Malaysia:? "The Malaysian Smart School Project."

[48]Australian Department of Education, Employment and Workplace Relations, "High Speed Broadband to Schools Overview" at http://www.deewr.gov.au/Schooling/DigitalEducationRevolution/

HighSpeedBroadband/Pages/HighSpeedBroadbandToSchoolsOverview.aspx

[49]Irish Department of Communications, Energy and Natural Resources. “Post-Primary Schools nationwide to receive High-Speed Broadband.” Press Release.? June 25, 2009.? http://www.dcenr.gov.ie/Press+Releases/Post-Primary+Schools+nationwide+to+receive+High-Speed+Broadband.htm

[50]http://www.teachernet.gov.uk/CaseStudies/images/downloads/documents/LGfL.pdf

[51]http://www.ntia.doc.gov/broadbandgrants/comments/6422.pdf

[52]For a detailed account on the use of wireless technologies for connecting schools in Namibia see: http://www.schoolnet.na/projects/wireless/snetwireless.pdf

[53]http://www.ictregulationtoolkit.org/en/Document.3487.pdf

[54]http://www.qualcomm.com/citizenship/wireless_reach/projects/education.html

[55]MOTOROLA, “Motorola’s MOTOwi4 Canopy™ Wireless Broadband Platform Scores Big Win in Becoming First National Network.” Press Release, 16 January 2006 http://mediacenter.motorola.com/content/detail.aspx?ReleaseID=8477&NewsAreaID=2 (accessed 13 September 2009).

[56]http://download.intel.com/intel/worldahead/pdf/casestudy_nigeria.pdf

[57]http://www.abs-cbnnews.com/technology/07/06/09/globe-usaid-launch-wimax-mindanao-schools

3.3.2 School network topology

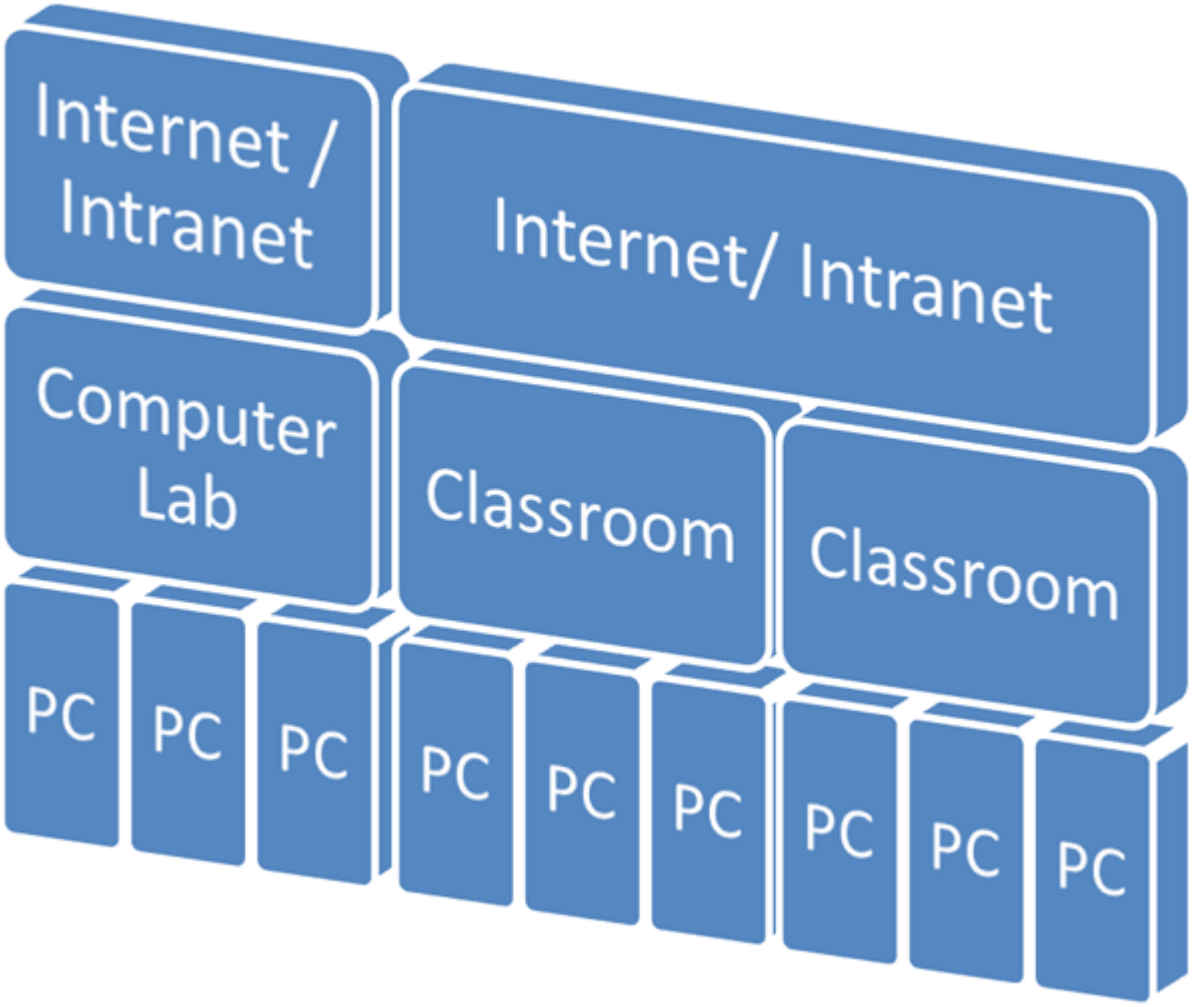
Several?options exist to?delive connectivity to and within?schools.? Given the limited bandwidth of dial-up access, a single school may deploy?several different connections in order to provide connectivity to multiple classrooms. ?Broadband is a better solution for supporting multiple access points over a single connection.??It can reduce costs, since multiple dial-up telephone lines are no longer needed.?

Instead of supplying each school with its own direct Internet access service, some countries have found it beneficial to create school intranets that connect educational institutions to an academic network.? This allows online educational materials to be exchanged and facilitates administrative processes between schools and the Ministry of Education.? An academic network can reduce Internet access charges by keeping academic traffic local rather than having it routed overseas.

Apart from the connection to the Internet, there are other networking aspects to consider -- particularly, how the Internet access will be distributed within a school.? This generally depends on computer

allocation strategies (see Figure below).? One approach is to?establish computer labs, reducing the need for multiple in-school connections.? In other countries, computers are distributed more widely within classrooms, or teachers use their own computers to present online content.? In the latter case, a school-wide Local Area Network (LAN) may?be necessary, which could increase costs and support requirements.

Figure 3-5: School Network Topologies



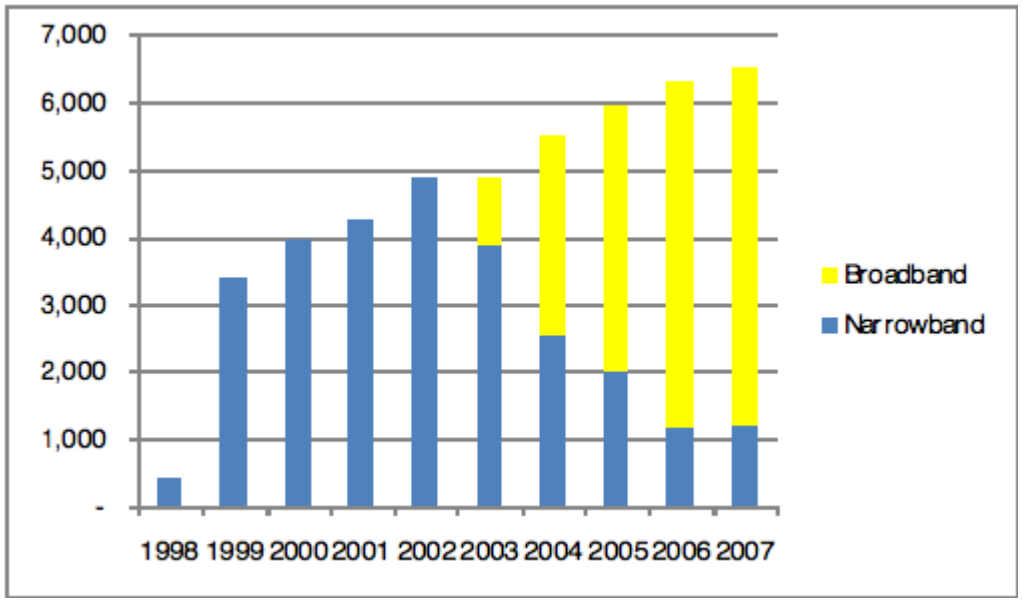
3.3.3 Upgrading from narrowband

While many schools have had no Internet access at all, others have benefited from narrowband connections – for example, dial-up or ISDN.? As the volume, complexity and size of online content have increased, so too have bandwidth requirements.

Narrowband connections may suffice for simple email and text-based research, but they do?not provide an acceptable user experience for multimedia downloading, videoconferencing or online collaboration tools.? Narrowband access can?also be more expensive than broadband, surprisingly -- particularly in countries where users have to pay telephone usage charges.? Dial-up connectivity is also not a good solution for redistributing access within schools.

Some countries, such as Chile, have established programs for migrating narrowband-connected schools to broadband.? In 1998, the Ministry of Education (MOE) and *Compañía de Telecomunicaciones de Chile* (CTC), the incumbent telecommunications operator, reached an agreement?for CTC?to provide free narrowband (i.e., 64 kbps) access to schools for 10 years.[58] In 2004, the MOE began encouraging broadband connectivity in schools, creating a fund to provide subsidies of?50-100 per cent for schools switching to broadband connections.? By 2007, 81 per cent of subsidized public schools with Internet access had a broadband connection (see figure below).

Figure 3-6:? Internet Availability in Subsidized Chilean Public Schools, by Type of Access



Source: Enlaces.

[58] http://portal.enlaces.cl/tp_enlaces/portales/tpee371c23bs52/uploadImg/File/libro_enlaces.pdf

3.4 Support

It's not enough to simply install network connections and walk away.? Governments need to allocate resources for ongoing school connectivity operations, maintenance and upgrades, in order?to ensure reliability and sustainability.? Although initial setup and operational assistance may be received from governments, development partners or the private sector, it is critical that schools have access to trained staff that can troubleshoot problems, perform routine maintenance and identify necessary upgrades.?

Technical staff need to be trained in network operation and maintenance, management of relationships with ISPs and software vendors, as well as network security and online protection.? This activity should be included in the overall school connectivity plan and properly resourced.

One training possibility is to contract with?the telecommunications operator that provides the Internet access to?train?the?technical staff.? There are also private-sector network training courses available in many countries. ?For example, the Cisco Networking Academy provides training on computer networks for?some 9,000 academies in 165 countries, graduating more than 800,000 students a year.[59] In Mexico, Networking Academy graduates have been providing technical assistance to Internet-connected primary and secondary schools.[60]

Outsourcing network maintenance is another option. In Jordan, the Ministry of Education has a contract with a local firm to support all connected schools.[61]

Some countries such as Namibia and Thailand have set up toll free call centers staffed by trained personnel to support school connectivity programs.

[59] http://www.cisco.com/web/learning/netacad/academy/index.html
[60] http://www.cisco.com/web/learning/netacad/success_stories/caseStudies/mexico.html
[61] http://linc.mit.edu/conference/presentations/toukan.ppt

3.5 ICT Sector Regulations and School Connectivity

School connectivity requires access to telecommunications networks and services.? It makes sense, then, that the degree of telecommunications liberalization impacts school connectivity, since market restrictions result in less competition, higher prices, poor quality of service and fewer connectivity options.

At the same time, telecommunications tends to be highly regulated in most countries.? This can have both negative and positive repercussions for school connectivity.? There may be regulatory restrictions that inhibit schools' connectivity options, such as a requirement to use only licensed operators or the inability to use certain radio spectrum frequencies.

There are positive benefits of regulation, too -- both direct and indirect.? For example, regulatory tools to expand Internet access in rural or remote areas can benefit schools by making infrastructure more available.? In some cases, there is an explicit school connectivity provision within the regulatory framework.?

3.5.1 Universal Service

Among the regulatory issues most relevant to school connectivity is universal access/universal service.??Not surprisingly, several?countries have coordinated or included school connectivity aims with?universal service programs in order to increase access to ICTs, particularly in rural and other under served areas.? In some cases, universal service programs?have been targeted directly?at schools.

3.5.1.1 Universal service fund

Many countries have established a universal service fund (USF), to which telecommunications operators contribute. The USF is?used for general objectives such as installing telecommunications networks in rural areas, but it is increasingly being? targeted to particular sectors such as schools.

How the?USF funds are?distributed varies from country to country. ?In some, operators bid to provide service in designated areas.? The winner is the operator with the lowest bid, and the?amount is then reimbursed from the USF.? In other countries, the USF is used to reimburse designated operators that?deploy infrastructure in targeted areas.? In some instances, the USF is used to subsidize tariffs for specific groups.?

In Latin America, many countries have established USFs aimed at increasing access to telecommunications services in unserved or underserved areas.? Some of these funds include specific provisions for school connectivity.

Ecuador offers one?example.? The country's universal service strategy includes support for providing Internet connectivity to schools, chiefly in areas where there is no existing access.? The objective is to provide the majority of schools in the country with Internet connections.? The telecommunications regulator (*Comision Nacional de Telecomunicaciones*, or CONATEL) is responsible for developing an annual plan that identifies universal service targets for?funding from FODETEL, the country's universal service fund.[62] FODETEL has financed a number of school connectivity programs, including a USD 469,000 project providing broadband connections and free Internet access to 74 schools in the Cantón Montúfar Municipality.[63]

[62]*Plan de Servicio Universal*, CONATEL, available at: http://www.conatel.gov.ec/site_conatel/index.php?option=com_content&view=article&id=26&Itemid=87

[63]http://www.conatel.gov.ec/site_conatel/index.php?option=com_docman&task=doc_download&gid=1062&Itemid=

3.5.1.2 Universal Service Obligations and Providers

An alternative to creating a fund for expanding telecommunications access in unserved areas is to impose universal service obligations directly on operators.? The advantage of this approach is that it avoids the delay and overhead costs associated with administering a universal service fund. ?It also makes sense when there is only one operator with an exclusive right to serve a given area.

This approach can be problematic, however,?if the telecommunications market is liberalized.? Imposing obligations on just one?operator may place?an unfair burden on that operator (usually the

incumbent).??Or, looked at another way, it proffers what can be?perceived as an unfair advantage to?operators not covered by the mandate.

The Bahamas Telecommunications Sector Policy of 2001 designated that the Bahamas Telecommunications Company (BTC), as the dominant provider, would carry out universal service obligations for the duration of its exclusivity period.? Among its universal service obligations, BTC had to provide free Internet access to all schools.[64] As the pertinent legal language explained:

> *"8.2 Government supports the principle identified by the 1995 United Nations Social Summit, that universal access to basic education and lifelong educational opportunities are preconditions for economic and human development. It is proposed therefore that as part of universal service, Internet access will be provided free of charge to:*
> *(a) all public and church-operated schools…*
> *8.4 Initially, and for the duration of the Exclusivity Period, any obligation to provide universal service will be imposed upon BTC as the dominant provider… Initially BTC will be obliged to: provide Internet access, inclusive of the supporting telecommunications services, to all schools free of charge.*
>
> ?

[64]Telecommunications Sector Policy 2001 (revised October 2002), Commonwealth of the Bahamas, Article 8.4, available at http://www.pucbahamas.gov.bs/download/telecom_sec_policy.pdf.

3.5.1.3 Coordinating universal service

Universal service funds have had a major impact on school connectivity in some countries, but there? is a tendency to believe that they are?the only thing needed?to achieve Internet access in schools. Some education ministries consider school connectivity an issue for the telecommunication sector to solve.? This can be problematic, however, because it?can divert attention away from?sustainability, as well as from efforts to?incorporate connectivity into the curriculum and to ensure that?teachers and students are trained to use online resources.

Also, most universal service funds are targeted at rural or remote areas and, therefore, will not resolve the lack of connectivity in underserved urban areas.? So?there should?be close coordination between

the ministry of education and the ICT ministry and regulatory agency, in order?to ensure that universal service funds and obligations are formulated within a plan for school connectivity that concretely describes the roles of all parties.? In addition, there should be a way to address the needs of schools that will not be connected with universal service funding.?

3.5.2 Spectrum

In many developing countries, access to wired telecommunications infrastructure is limited, particularly in rural areas.? Wireless connectivity?is a?more viable solution for providing schools Internet access in such areas.? Government policies regarding spectrum allocation and use can?greatly impact school connectivity.

3.5.2.1 Allocation

Spectrum is a scarce resource and, depending on the frequency and market conditions, a licence can be highly costly to obtain.? Therefore, governments might allocate some portion of radio?spectrum for educational broadband service,?ensuring that schools can benefit from wireless communications. ?

In the United States, the Federal Communications Commission (FCC) first allocated spectrum in the 2500-2690 MHz band to education in 1963 for broadcasting of instructional material.[65]? The FCC restructured the program in 2004,?allowing educational institutions to use this spectrum for so-called Educational Broadband Services (EBS), in addition to broadcast transmissions.?

[65]Federal Communications Commission, see,?In *the Matter of Amendment of Parts 1, 21, 73, 74 and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands,* WT Docket No. 03-66 at 9 (Rel. Apr. 2006), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-46A1.pdf.

3.5.2.2 Reduced spectrum fees

Another regulatory tool that governments may use to increase wireless broadband connectivity for schools is to reduce or waive spectrum fees for academic institutions.

The Malawi Library and Information Consortium (MALICO) has focused on establishing broadband connectivity to Malawian?institutions.? It?launched a satellite-based Very Small Aperture Terminal (VSAT) network in 2005.[66?] To assist with MALICO's project, the Malawi Communications Regulatory Authority (MACRA) waived most of the VSAT fees in order to reduce the program's implementation and operating costs.

By providing broadband access to schools via satellite, MALICO has been able to overcome problems associated with the lack of telephone line penetration in Malawi, particularly in rural areas.? As of September 2008, the program was delivering 1 Mbps via uplink and 256 kbps on the downlink to four universities and colleges.

[66]MALICO, VSATs and Connectivity (2008), available at http://www.malico.mw/vsats.htm.

3.5.2.3 Unlicensed spectrum

Unlicensed spectrum refers to radio frequency bands that may be used without a licence.[67] Many countries have allocated spectrum in the 900 MHz, 2.4 GHz, and 5 GHz bands for unlicensed use.? The 2.4 GHz band, in particular, is popular for providing Wi-Fi connectivity within schools.? Since users of unlicensed spectrum do not need to pay fees for assignments, the costs of building a network are lower than other wireless broadband options.

In South Africa, the *Ulwazi E-Learning Partnership* has connected schools using Motorola's wireless broadband access technology.[68]? The broadband network operates in the 5 GHz band, which is an unlicensed band in South Africa.? The pilot project linked five schools in the Pretoria area with broadband connectivity, completing the deployment?in just two days.? There is a?possibility that the project will be?expanded nationwide.?

[67]However, licence-exempt equipment is not?given protection against interference and must operate at low output levels,?limiting the signal's range.?

[68]Motorola, Case Study: Gauteng, South Africa, "Wireless Broadband Brings E-learning to South African Schools", available at http://www.motorola.com/staticfiles/Business/Solutions/Industry%20Solutions/Education/MOTOwi4/_Documents/static%20files/South-Africa%5B1%5D.pdf?localeId=33.

3.5.3 License obligations

In most countries, telecommunication operators are awarded licences that specify their rights and obligations.? Conditions can be included in licences, such as roll-out requirements and nationwide coverage.? Although the conditions are often defined in general terms, there are examples of specific requirements for the education sector. ?

The Ministry of Communications in Brazil recently launched the *National Rural Telecommunications Program*, which is?intended to increase Internet access for rural populations.? The program is linked to the 450-470 MHz band spectrum auction.? As part of the licence conditions, companies?awarded?spectrum will be required to provide free Internet access for rural public schools in?their?concession areas.? They were expected to launch services by 2010, and to cover their entire concession areas by 2015.? The Ministry of Communications aims to achieve Internet coverage for more than 80,000 schools in rural areas through the program.? ANATEL, the country's telecommunication regulator, will have the task of?devising measures to implement the directive.[69?]

Brazil also provides an example of modifying licence conditions in favor of school connectivity.? The Ministry of Communications developed its *Broadband in Schools* program in 2008.? Originally, telephone service operators had obligations under their licences to provide public pay phones.? The Ministry and the operators agreed to eliminate this obligation in favor of one requiring?operators to provide connections of at least one Mbps to urban public schools, at no cost.? As of July 2009, more than 50 per cent of Brazil's 56,720 urban public schools were connected under the program and 100 per cent of these schools must be covered by the end of 2010.[70]

In South Africa, the Independent Communications Authority of South Africa (ICASA) issues licences with?obligations designed to?lessen the "digital divide."? As part of its "community service obligation" (CSO) , telecommunication operator Neotel must provide high-speed Internet connectivity to public schools and other educational institutions.[71]

Another example is mobile operator Vodacom.??As part of its 3G licence obligations, Vodacom?is required to provide broadband wireless connectivity to 5,000 schools over an eight-year period.[72]? The implementation of these obligations depends on the Ministry of Education acting to identify the schools to be connected.

[69]Portaria No. 431 on National Rural Telecommunications Program, 23 July 2009, available at: http://www.mc.gov.br/noticias/2009/ministerio-das-comunicacoes-cria-programa-nacional/
[70]http://portal.mec.gov.br/index.php?option=com_content&task=view&id=10264
[71]Neotel – Community Service Obligation, available at http://www.neotel.co.za/neotel/view/neotel/en/page44872.
[72]http://www.vodacom.com/education.php

3.5.4 Tariffs

Another approach that can be used to reduce connectivity costs is?the provision of special tariff arrangements for schools.? Operators may choose to provide special, flat-rate prices or discounts exclusively to schools.

In the UK, British Telecom was the first operator in Europe that offered a flat-rate telephone and?basic ISDN access service to schools.[73?] In the Maldives, incumbent operator Dhiraagu provides lower broadband tariffs to schools through a special arrangement with the Ministry of Education.[74]

[73]"Bringing the Internet to Schools: US and EU Policies" by Michelle S. Kosmidis, delivered at the Telecommunications Policy Research Conference, October 2001.
[74]http://www.dhiraagu.com.mv/internet/incentives.php

3.5.5 Competition issues

Using a country's regulatory framework to require a?telecommunication operator to provide school connectivity can have repercussions for competition.? Of course, this is not an issue where?the incumbent?operator has?legal exclusivity, because there are no?competitors to?worry about.? But? such monopoly situations are becoming rare as countries liberalize their telecommunication sectors and introduce facilities-based competition.

There are advantages and disadvantages of requiring one operator to connect schools.? One advantage is a minimization of administrative complexity and costs.? Working with just one operator—typically the incumbent, which?generally has the largest nationwide network—eliminates the need to coordinate school connectivity among different suppliers.? It also might reduce overall costs, since a single operator can achieve economies of scale by aggregating schools and standardizing connectivity requirements.

It can also lower administrative costs and speed up deployment, since other methods to allocate school connectivity among mulitple operators are not needed. That is an important consideration for countries where there are limited personnel and technical resources for?telecommunication regulatory agencies.? A single operator can internalize the costs of connectivity, eliminating the need to?administer a special fund and reducing inherent delays in implementing and disbursing subsidies.?

One?problem with obligating a single operator to connect schools, however,?is that it may be contrary to a country's legal or regulatory framework.? Although the exclusivity only applies to serving a specific market segment, rather than the overall provision of connectivity on a commercial basis, it still might be interpreted as anti-competitive within the legal framework of some countries.

?A second disadvantage is that other operators may complain about not being able to serve the educational market.? This may have negative public relations aspects, since such operators may be perceived as not contributing to the country's social development.

Another disadvantage is that operators with?school connectivity obligations do not always provide the service for free.? There may have been an initial requirement to provide schools with a telephone line or wireless coverage at no charge.? However, there is sometimes a monthly service payment required, even if that payment is discounted.??If the monthly charge is?waived, this may only be for a set period, after which the charge is applied.? If schools have to pay something to recoup part of the operator's?costs, this may well subsidize operational inefficiencies.

At the same time, requiring the incumbent to implement school connectivity imposes an additional burden that will raise the operator's costs, making it less competitive than other operators. This may be perceived as a positive development, since it?tends to level the playing field --?given the incumbent's historical advantages.

There are different options to alleviate competition concerns about requirements for operators to provide school connectivity.? These include:

- Ensuring that all operators have the same obligations, such as by including school connectivity in licence conditions.? This could be an across-the-board requirement, such as obligating each operator to connect a certain number of schools or weighting the number of schools to be connected according to size or market share of operators.
- A?*reverse auction* scheme?to subsidize school connectivity through universal service funds.? This involves having all interested operators bid for the right?to?provide school connectivity. The lowest bid wins that right and is?reimbursed the amount of its bid from the universal service fund. The auction could be designed to provide nationwide, regional or local?connectivity.
- A “pay or play” mechanism, whereby operators can either contribute to a universal service fund or provide universal service (such as school connectivity) themselves.

3.6 Funding

There are significant challenges in managing the costs associated with school connectivity.? These costs are often substantial, and they pose a significant economic burden on the education community.? It is important to determine how connectivity can be financed.? This needs to be decided?for both the initial outlay of monies to obtain equipment and establish connections, as well as the support for connectivity?in the long term.

The initial economic costs of school connectivity are largely based on the telecommunication costs for providing connectivity, whether through?fixed telephone lines, wireless access, satellite service, or the accompanying Internet service provider charges.? In addition, calculation of connectivity costs should include?the costs for computer hardware, network wiring, modems, routers, network file services, and wireless local area networks.

The cost of computers and other supporting equipment can exceed the connectivity costs, particularly if a one-to-one computing model (i.e., providing each student with a laptop) is adopted (see the discussion in Section 5 Cross-Cutting Issues?on?“Low cost computing devices for schools initiatives”).?

Funding Sources

While connectivity costs can be substantial, there?multiple sources of funding are available.? Given the variety of funding options, countries should develop a comprehensive approach?to obtaining financial resources.??This should cover not only?initial school connectivity costs, but also?the costs of expanding and sustaining Internet access.? Governments should develop school connectivity strategies that allow for the participation of multiple actors from both the public and private sectors.

Key sources of funding will be allocations stemming from ministry budgets and universal service funds.??It is important to review?such sources of funding, in order to ensure that they take school connectivity needs into consideration in their?future funding cycles.

Countries can also encourage telecommunication service operators to carry out school connectivity programmes.? Governments should?seek funding from multilateral and bilateral entities, wherever possible.? They can work to get the private sector involved in school connectivity projects by establishing public-private?alliances and partnerships.? In addition, countries can work with NGOs and other civil society representatives to help?implement and manage school connectivity programmes.

3.6.1 Government

Government funding for education varies widely around the world.? Most governments with a strong commitment to education have backed up their policies with significant funding.? One area in which governments can publically prove their dedication to education is by funding school connectivity.? While?resources may be available from other sources, those funding partners will want to see a concrete financial commitment by the government to indicate long-term sustainability.

In order to fund school connectivity, governments must either increase or reorient education budgets.? Additional government-related funding options include utilizing telecommunication sector regulatory tools such as universal service funds or implementing preferential tariffs and discounts for schools to obtain Internet access.

An example of?government funding responsibility is found in?Chile's *Center for Education and Technology*, known as?*Enlaces.??*Administered by?Chile’s Ministry of Education, Enlaces established the *Funds for Broadband* program in 2004.??Through this program, Enlaces provides funds for

subsidized broadband Internet connectivity?in schools.? Enlaces also manages?the digital education network that?connects public primary and secondary schools throughout Chile.

The Enlaces funds?help to co-finance Internet connectivity service so that schools have adequate connection speeds for equipment in classrooms, teacher lounges, and libraries.? According to Enlaces, 75 per cent of subsidized schools have access to the Internet, and 67 perc ent of these have access to broadband. ?In 2008, 2,644 schools?were granted funds for broadband Internet connectivity.[75]? Chile's *Technologies for a Quality Education Plan,* announced in 2007, foresees an additional USD 200 million being spent on school infrastructure, including connectivity and computers, through 2010.

The Philippines provides an?example of reallocating existing funding.??The Department of Education (the federal education ministry) is?reorganizing its budget to fund the country's plan to provide Internet access to all public high schools.[76]

[75]Centro de Educacion y Tecnologia – Enlaces, Ministerio de Educacion, available at: http://portal.enlaces.cl/?t=44&i=2&cc=1278&tm=2 and http://portal.enlaces.cl/?t=44&i=2&cc=1278&tm=2

[76]http://www.deped.gov.ph/cpanel/uploads/issuanceImg/DO%20No.%2050,%20s.%202009.pdf

3.6.2 Telecommunications operators

Telecommunication operators have been an important funding resource for providing school connectivity in many countries.? Such funding is often?raised indirectly, through operator contributions to universal service funds, which are then used to build out infrastructure in rural and underserved areas.? In some cases, portions of universal service fund outlays are earmarked for educational connectivity.

?Another regulatory method used to involve operators in school connectivity has been to?implement school funding obligations as part of licensing.? There may also be legal conditions that require operators to offer educational institutions discounted tariffs for telecommunication services.

Some governments have appealed to telecommunication operators to address school funding, even when there is no regulatory requirement to provide school connectivity.? This is sometimes implemented through operators'?*social responsibility* programmes, which?are generally guided by a

written agreement between the government and the operator.? The table below provides some examples.

Table 3-6: Telecommunications operator projects for school connectivity, selected countries

Country	Operator	Description
Belize	Belize Telemedia Limited (BTL)	A BTL social responsibility project, “Internet to Schools,” provides free broadband (i.e., 256 kbps DSL) Internet access to 45 primary, secondary and tertiary schools.[77]
Chile	Compañía de Telecomunicaciones de? Chile (CTC)	Under the “Educational Internet 2000” project, launched by the Ministry of Education, CTC agrees to provide Internet service to primary and secondary schools, free of charge, for 10 years. [78]
Germany	Deutsche Telekom	Through Telekom’s corporate responsibility activities, the “Telekom@School” initiative has connected all 34,000 general education and vocational schools to the Internet, free of charge.? Of those schoos,?about 30,000 have a DSL broadband connection.[79]
Slovak Republic	Slovak Telekom	In 2002, the Ministry of Education and Slovak Telekom agreed to a Memorandum on Cooperation as part of the eSlovakia programme.??Slovak Telekom will provide Internet access to primary and secondary schools.? Some 99?per cent of Slovakia’s 3,500 primary and secondary schools now have Internet access; some 60?per cent have?a broadband ADSL connection.[80]
Uruguay	Antel	Through an agreement with the Ministry of Education, Antel will provide Internet connections to all public primary and secondary schools. By 2008, some 1,395 educational institutions were connected with the following technologies: ADSL (798), EDGE (577), Satellite (19) and 3G (1). All public schools were to be connected by the end of 2009.? Antel also agreed to provide space in telecommunication towers and masts for ICT projects in education.[81] [82]

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[77]http://www.belizetelemedia.bz/education2.php

[78]http://info.worldbank.org/etools/docs/library/98771/Policy%20Makers%20workshop/policymakers/docs/resources_sp/Acta_Convenio_IE2000_Chile.pdf

[79]T-Mobile Broadband in Schools page, available at:? http://www.telecom.com/dtag/cms/content/dt/en/676864

[80]http://www.slovaktelekom.sk/en/Default.aspx?CatID=1483&Section=3&Template=Print

[81]http://www.elpais.com.uy/081226/ultmo-389562/ultimomomento/antel-subsidia-conectividad-de-escuelas-para-plan-ceibal

[82]http://www.antel.com.uy/

3.6.3 Multilateral and bilateral development agencies

Assistance from multilateral and regional development agencies can help with the costs of school connectivity.?? Institutions such as The World Bank, the Asian Development Bank and the Inter-American Development Bank can provide funding, as can?bilateral aid agencies from developed countries.

Funding is often in the form of loans covering an overall education reform project, of which school connectivity is one component.? There are also cases where grants are provided, typically for pilot projects. The variety of projects, regions and lenders suggests that countries with a feasible and sustainable school connectivity plan might find support from these agencies.

Examples of multilateral assistance include:

- The World Bank has funded education projects throughout the developing world, including those with?ICT components.? In Jordan, the *Education Reform* for *Knowledge Economy* project supports the creation of computer labs in schools, including the provision of Internet access.[83] The Bank's largest ICT for education project is in Russia, which has "substantially increased technology infrastructure both at the central/federal level of education system and at the regional/local level, and by this provided greater physical access to technology for users from distantly located/rural areas." [84] The World Bank also instigated the *World Links* project,

which helped with school connectivity in some developing countries and was later spun-off as an independent, not-for-profit organization.[85]

- The Asian Development Bank helped to fund the *Sri Lanka Secondary Education Modernization Project,* which ran from 2000 to 2007.[86]? The project included a component for creating over 1,000 "computer learning centres" in secondary schools.? The centres?include?Internet access.[87]
- The Inter-American Development Bank (IDB) has a long history of supporting school connectivity in Latin America and the Caribbean.? It has provided assistance for various school connectivity projects in?countries such as Argentina, El Salvador, Nicaragua and Trinidad and Tobago.[88]? Along with the Caribbean Development Bank, the ADB provided funding for the Barbados *Education Sector Enhancement Programme* (EduTech), which led to Internet access for all primary and secondary schools.[89] In addition, the IDB is assisting with funding of several school computer programs that have a connectivity component.? In Haiti, the *One Laptop per Child Model Project* includes funding for connectivity.? Likewise, a pilot project for Paraguay includes a connectivity component featuring two-Mbps Internet access at?10 schools and underwriting of associated cabling, routing and maintenance costs.

Examples of bi-lateral funding include:

- The Japanese government has provided assistance to the ASEAN *SchoolNet* project, which supports pilot school connectivity projects in Cambodia, Indonesia, Laos, the Philippines and Vietnam.[90]
- The Swedish International Development Cooperation Agency (SIDA) has provided ongoing financial assistance to Namibia's *SchoolNet* project, which provides Internet access to schools.? SIDA has contributed close to NAD 23 million (USD 2.9 million) since mid-2001.[91]
- The United States Agency for International Development (USAID) has provided assistance to?school connectivity projects around the world.? For example, it helped fund the *Macedonia Connects* program, which led to the provision of wireless broadband access to all of that country's primary and secondary schools.[92] It also helped with financing of a high school connectivity project in Yemen, with a focus on girls' access to ICTs.[93]

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[83]http://web.worldbank.org/external/default/main?pagePK=64027221&piPK=64027220&theSitePK=315130&menuPK=315162&Projectid=P075829

[84]http://siteresources.worldbank.org/EDUCATION/Resources/278200-1121703274255/1439264-1245102696247/Russia_E-Learning_Support_Project.ppt

[85]http://www.world-links.org

[86]http://www.adb.org/Documents/PCRs/SRI/33245-SRI-PCR.pdf

[87]http://www.schoolnet.lk/index.php?lang=en&for=default&page_id=38

[88]The One Laptop per Child Initiative: A Framework for Latin America and the IDB, Annex 1, pgs. 17-18, available at: http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=846461

[89]http://www.mes.gov.bb/pageselect.cfm?page=89

[90]http://www.mofa.go.jp/policy/economy/it/asia/coop0107.html

[91]http://www.schoolnet.na/news/stories/sidaphaseii.html

[92]http://macedonia.usaid.gov/English/EDU/Macedonia_Connects.htm

[93]"The Yemeni High School Internet Pilot Project." *DOT-COMments*. December 2005.

3.6.4 Private sector

Some?private-sector companies, mainly in the high-tech arena, provide support for educational connectivity.

Through its *EducaRed* program, Fundacion Telefonica promotes the use of ICTs in classrooms.??It?aims to?improve the quality of education and encourage opportunity equality through the use of ICTs in teaching and learning procedures.? In the Americas region, the EducaRed program operates in Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.? Fundacion Telefonica is a social-development effort of the Spanish operator Telefonica.

The *Aulas* initiative within the EducaRed program specifically focuses on providing connectivity and technological resources for classrooms, as well as capacity training for teachers and students.? The Aulas initiative has helped to set up ICT-enabled classrooms in schools and?hospitals, so children can continue to have access to education.[94]

Qualcomm, a U.S. wireless technology and services firm, supports educational connectivity through its *Wireless Reach* initiative.? This effort?works with local and international partners to support the use of wireless technologies in developing countries, particularly in the areas of education, entrepreneurship, healthcare, and safety.?

In Guatemala, Qualcomm has partnered with the Ministry of Education (MINEDUC), the Fundacion Sergio Paiz, USAID, and the telecommunication operator TELGUA to assist MINEDUC in? implementing its *Schools of the Future* project.? Started in 2006, the initial stage of the project is focusing on introducing advanced wireless technology?in 400 Guatemalan schools.? The project will?conduct a review every 18 months to make improvements and to determine the effects technology can have on education.? The goal is to use this group of schools as a model that can be replicated at other schools throughout Guatemala.[95]

In Indonesia, Wireless Reach has helped to establish computer laboratories?that provide Internet access to more than 1,000 students in five high schools.[96]

The U.S. semiconductor company Intel supports school connectivity through various projects, primarily through partnerships that have allowed?Intel to?provide computers and?assistance to obtain broadband wireless Internet access.? Intel is working with NEPAD to provide connectivity and access in countries across Africa, such as Intel-powered computer labs in Lesotho, assistance with WiMAX broadband connectivity in Ghana, and programs in Nigeria to encourage purchase of PCs for home use and to train teachers?to incorporate technology into instruction.

[94]Fundacion Telefonica – EducaRed, available at: http://www.fundacion.telefonica.com/educared/
[95]Qualcomm-Wireless Reach Initiative, available at: http://www.qualcomm.com/citizenship/wireless_reach/index.html
[96]http://www.qualcomm.com/citizenship/wireless_reach/projects/education.html#indonesia

3.6.5 Non-Governmental Organizations

Non-governmental organizations (NGOs) play a significant role in carrying out initiatives to establish school connectivity.? They usually establish partnerships and alliances with national, regional, and local governments, international entities, telecommunication sector stakeholders, and the private sector.? Although NGOs do not typically provide significant funding, they have been instrumental in coordinating and managing projects among different stakeholders.

For instance, the *Fundacion Omar Dengo* in Costa Rica works with the country's Ministry of Public Education to implement a national program that focuses on providing access to digital technologies in schools in rural and socially vulnerable areas.? The Fundacion, a non-profit private entity, has

managed and executed national and regional projects and programmes that have brought together educational innovation and new technologies,?benefitting 1.5 million people in Costa Rica since its inception in 1987.[97]

Computers for Schools Kenya (CFSK) is modeled after the award-winning *Computers for Schools Canada*.? CFSK distributes PCs in Kenyan schools,?working with a range of partners.??So far,?it has distributed?more than?18,000 computers and?has been involved in providing school connectivity in 16 schools.? This includes a project with the GSM Development Fund and local mobile operator Safaricom to provide Internet access using cellular EDGE technology.[98]

[97]Fundacion Omar Dengo, available at: http://www.fod.ac.cr/principal

[98]GSM Association. 2006. Development Fund: A First Year of Progress.

3.6.6 Other

Though not as common or significant as the funding sources listed above, there are other sources of funding available. In some cases, they offer in-kind or volunteer resources which though not covering connectivity costs, help to defray associated expenses such as training or support.

Parents are an important source of funding. In private schools the tuition fees they pay help to defray costs associated with school connectivity if these expenses are included in the tuition. Parents can also be approached to contribute to special fund raising drives for school connectivity.

The transfer of skills through academic networking is another source of help. For example educational experts from Estonia are working with counterparts in the country of Georgia to transfer their know-how. Estonia's successful Tiger Leap project for school informatization is being adapted to a Georgian "Deer Leap" version.[99]

[99]Deer Leap is a national project aimed to support the educational system in Georgia and provide for school connectivity.? It is a partnership with the Ministry of Education and Science of Georgia and the Regional Development Agency of Georgia.? See http://www.htk.tlu.ee/TLG

3.7 Monitoring and evaluation

Monitoring and evaluation are critical component for school connectivity projects.?? An effective plan should include methods to (1) evaluate the technical results of Internet connectivity, (2) measure progress towards school connectivity and (3) analyze the impact of broadband access on learning. ?

Countries with the intention and resources to provide Internet access in schools will want to carry out pilot projects to assess the technical solutions. This is also relevant for countries where schools have narrowband access but now desire to upgrade to broadband.? Even in countries with?widespread school connectivity, there may be a desire to evaluate new access technologies because of cheaper costs or better performance.

The evaluation should examine if the type of Internet access used (e.g., ADSL, fixed wireless, third generation mobile, VSAT, etc.) works as expected, whether it can support the number of access points with sufficient bandwidth and what costs are?expected.[100]? The evaluation also provides information about the overall costs of connectivity, such as monthly access tariffs, the costs of retrofitting schools with cabling and redistributing access throughout a school and training and support expenses. These results can then be used to refine the technical solution prior to implementation on a wider scale.

Monitoring

Monitoring is also essential for tracking school connectivity deployments to assess whether they?are advancing according to plan. This should cover both new deployments and upgrades from narrowband to broadband connectivity.

Metrics for measuring deployment are fairly straightforward. The *Partnership on Measuring ICT for Development,* a group of international agencies, has recommended eight core indicators that countries should collect regarding ICTs in schools.[101]

The basic statistic is to *track the number of primary and secondary schools with Internet access* (broken down by narrowband and broadband access and public and private schools) and compare it to targets set within a plan. The statistic can also be used to derive indicators such as the percentage of schools with Internet access. Additional statistics can be compiled, and indicators derived, depending on the desired level of analysis.? This would probably include a breakdown by primary and secondary schools with additional disaggregation to gauge the impact of specific populations such as the poor,

females, persons with disabilities, minorities, ethnic groups, rural inhabitants, etc. This requires extrapolating the number of children affected by the school connectivity.

Table 3-7: Basic Indicators for Monitoring the Status of School Connectivity Deployment

Date	Primary	Secondary	Total
Total number of schools	?	?	?
Total number of students	?	?	?
Number schools with Internet access	?	?	?
Number of schools with broadband Internet access	?	?	?
Number of students covered by Internet access	?	?	?
Number of students covered by broadband Internet access	?	?	?

In addition to comparing the actual status to deployment plans at specific milestones, the monitoring?of school Internet connectivity is useful for other applications. For example governments may want to benchmark their school connectivity progress to other countries at similar socio-economic levels.

Despite the fundamental importance of monitoring, it is surprising how few countries compile and publicly disseminate clear and comparable statistics on the status of school connectivity.? Collection of the school connectivity statistics should not impose an extra burden on educational systems.? Nearly?all education ministries?publish statistics on?the numbers of schools, students, teachers, completion rates, enrollment rates, etc.? The number of schools with Internet access should be collected as part of the regular data-gathering processes when schools are asked about those other educational statistics.

Once broadband connections are in place, other indicators that could be employed to gauge the effectiveness of investments in broadband connectivity include:

- Number of teachers trained in?broadband-enabled curricula and tools;
- Level of use of broadband-enabled tools or curriculum in classrooms;
- Measurement/testing of students' ICT abilities;
- Measurement/testing of student performance in subject areas expected to benefit from broadband-enabled curricula and tools;
- Amount of time that school-based "telecentres" are available to the community;

- Number of users of school-based "telecentres"; and
- Percentage or absolute amount of school budget committed to online educational materials.

An important goal is the impact of school connectivity on the learning process as well as on the socio-economic development of the community. Medium-term and long-term objectives can also be assessed, including:

-?Changes in classroom management practices after the introduction of new technologies,

-?Improvements in?perceived educational trajectories of beneficiary students,

-?Higher values placed on education by beneficiary families and lower drop-out rate of beneficiary students, and

- Improved performance on standardized tests.

In order to obtain a complete assessment, quantitative and qualitative measurements are important, including test scores or grades, surveys, observation and interviews. The use of an internationally recognized testing instrument can provide not only legitimacy to test results, but a means to compare educational performance against international benchmarks.

A related approach would be for policymakers to identify the benefits delivered by a school connectivity project across a range of development outcomes.? For example, policymakers could identify the effects of a connectivity project in terms of progress made toward the Millennium Development Goals,[102] or toward a specific goal, such as poverty reduction.? By leveraging school connectivity projects, national policymakers could spur progress on goals such as child health, maternal health, combating HIV/AIDS, environmental sustainability, and global partnership – as well as universal education and gender equality, as mentioned in Section 2.1.1 – through such byproducts of school connectivity as access to information, improved educational opportunities, and expanded capability to communicate and collaborate.

Another example would be to follow the lead of the U.S. Trade and Development Agency (USTDA), which looks at benefits across five areas to gauge the impact of its assistance projects:[103]

- **Infrastructure**:??Identifying telecommunication facilities to be constructed, the expected connectivity level enabled by such infrastructure, and the number of anticipated users.

- **Market-Oriented Reform**:? A description of any regulation, laws, or institutional changes that are recommended, and the effect they would have if implemented.
- **Human Capacity Building**:? The number and type of positions that would be needed to construct and operate the proposed project, as well as the number of people who would receive training.
- **Technology Transfer and Productivity Enhancement**: A description of advanced technologies that will be implemented as a result of the project, and description of efficiencies gained.
- **Other**:? Any other developmental benefits to the project.

The examples above provide ideas for how to measure progress, gauge effectiveness and determine development impacts of school connectivity.? Policymakers will need to determine the metrics and milestones that will best allow them to determine the effects of their investment in educational broadband, while keeping in mind that the metrics will likely require recalibration?periodically.[104]

[100]Intel Corporation, "Deploying 1:1 e-Learning Environments for the 21st Century," 2007

[101]Statistical Commission Background document. Fortieth session, 24 - 27 February 2009. Items for information: Information and communication technology statistics - REVISIONS AND ADDITIONS TO THE CORE LIST OF ICT INDICATORS, Prepared by the Partnership on Measuring ICT for Development – see http://www.itu.int/ITU-D/ict/partnership/material/CoreICTIndicators_e_rev2.pdf . In addition, Canada, the European Union and the United States have produced statistical reports tracking connectivity in their countries. They provide good examples of the kinds of metrics used. See:
Wells, J., and Lewis, L.? (2006). *Internet Access in U.S. Public Schools and Classrooms: 1994–2005* (NCES 2007-020).? U.S. Department of Education.? Washington, DC:? National Center for Education Statistics.? http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2007020
Johanne Plante and David Beattie. (2004). *Connectivity and ICT integration in Canadian elementary and secondary schools: First results from the Information and Communications Technologies in Schools Survey, 2003-2004*. Statistics Canada.
empirica. (2006). *Benchmarking Access and Use of ICT in European Schools 2006*. European Commission.

[102]The Millennium Development Goals, available at: http://www.un.org/millenniumgoals/bkgd.shtml.

[103]United States Trade and Development Agency, "Proposal and Budget Model Format," Annex VI, available at http://www.ustda.gov/program/ModelProposalFormat_USFirms.doc.

[104]Wagner, Daniel A., Bob Day, Tina James, Robert B. Kozma, Jonathan Miller and Tim Unwin. 2005.

Monitoring and Evaluation of ICT in Education Projects: A Handbook for Developing Countries. Washington, DC: infoDev / World Bank. Available at: http://www.infodev.org/en/Publication.9.html

4 Leveraging Internet school connectivity

In addition to serving educational needs, broadband-connected schools and libraries can serve as government-funded institutions that are well-suited?as ICT centres for the surrounding local populations.? ?In areas where economics, infrastructure or other factors may present barriers to widespread broadband connectivity, policymakers can use educational?institutions?to offer access, training, and support services.?

4.1 School-based telecenters

While the connection of schools to the Internet via broadband is a worthy goal in and of itself, the benefits can be multiplied by taking advantage of the sunk costs of equipment and connectivity, as well as the administrative and management structure of the school, in order to provide services to the broader community during non-school hours.

School-based telecentres can offer services similar to Internet cafés, such as access to PCs, Internet connectivity, and video and audio communications software.? Instead of being purely driven by profit, school-based telecentres are also focused on meeting community needs, particularly for rural and underserved populations.

School-based telecentres have several benefits over for-profit Internet cafés:

- **Natural clientele** – Students who need or want ICT access for school projects take advantage of the online resources and may tout their benefits to family members or other non-students.
- **Life skills and vocational training** – Outside of school hours, telecentres can leverage computers and Internet connections to offer life-skills training tailored to the communities in which they are located, as well as vocational training.
- **User fees** – Any fees charged to non-students can be reinvested to update equipment, improve connectivity, or provide additional training.
- **Existing administration** – Leveraging school administration and management personnel allows telecentre staff to focus on training and support roles rather than management tasks.

- **Government involvement** – Given the involvement of local and/or national governments in school funding and operation, school-based telecentres may benefit from subsidized Internet connectivity, favourable taxation regimes, or bulk procurement opportunities.
- **Financial stability** – As an element?of the school, the telecentre is less dependent upon user fees for rent and utilities.? In addition,?wherever students pay tuition or there are parent-teacher or community organizations that are able to raise funds for school use, such funds indirectly contribute to telecentre operations.? Further, the costs of school connectivity can be spread over a larger user pool, creating a lower per-user cost. ?

School-based telecentres can encounter challenges, including balancing the needs of students and those of?the community at large.? Management must?understand the needs of both communities, as well as logistical challenges that may include a?lack of electricity in evening hours.

School-based telecentres have been in operation for several years, with Zimbabwe's *World Links for Development* (WorLD) often cited as one of the earliest programmes.? WorLD began in 1999 with the establishment of 12 telecentres for combined student and community use, funded?with World Bank support.??By 2002, WorLD was supporting 45 telecentres across Zimbabwe.[105]

The World Links program drew on its Zimbabwe experience to expand to other countries and to develop a training program on the establishment of school-based telecentres.? *SchoolNet Uganda*, a World Links partner, established a network of rural, school-based telecentres with additional funding from the Bill and Melinda Gates Foundation, while *SchoolNet Nigeria* also operates school-based telecentres for afternoon use by the community.

In a slightly different model, the *Partners of the Future* in São Paulo, Brazil, did not specifically develop telecentres, but instead offered community-oriented technology training in school computer?labs during non-school hours.[106]? Although general PC usage training does not require broadband connectivity, such programs are enhanced by the ability to provide broadband-enabled services.

In Sri Lanka, schools in the?*Computer Learning Centers* (CLCs) programme recover a portion of their operating costs by providing services to the public after school hours.? The Ministry of Education issued a regulation allowing schools to keep the money earned from telecentre services instead of transferring it to the central treasury.?? About 90 per cent of schools with CLCs provide after-hour use, with?70 per cent of them earning a profit.? The earnings have been used to pay for access, electricity, maintenance and repairs, and to purchase printers and scanners.[107]

[105]Bloome, Anthony, “School Networking Initiatives and School-Based Telecenters: Background Note for Ethiopian Country Team,” World Bank, December 2002.

[106]“Case Study: "Projeto Parceiros do Futuro (Partners of the Future), Sao Paulo, Brazil,” http://info.worldbank.org/etools/docs/library/91628/telecentres/telecentres/workshop/sbt-pdf/case-studies/BrazilCaseStudy.pdf

[107]http://www.adb.org/Documents/PCRs/SRI/33245-SRI-PCR.pdf

4.2 Connected schools as anchor institutions

Another means of leveraging broadband-connected schools is extending connectivity in a locality once an Internet access point has been established at a nearby school.

To achieve this, it is important to create a regulatory regime that enables or directs?educational institutions to share their connectivity.? One way to consider this concept is to view broadband-connected schools as regional “hubs” or “anchor points,” from which broadband connectivity – perhaps at a lower throughput than that delivered to the school – can be shared with the surrounding community.?

In comments directed at broadband planning in the United States, Microsoft has made?a case for schools (as well as other community institutions) as anchor points that will enable further broadband connectivity.[108] In Microsoft’s view, and according to its research, the most daunting expense of delivering rural broadband connectivity is the “middle mile,” or the portion connecting a town or region to the Internet backbone.? Once that connection is established, opportunities can be presented for the connected institution or private sector actors to leverage that broadband connection to provide service to local residences or businesses.

In the case of less-developed countries or regions, wireless technologies make Internet connectivity within a community more feasible.? For example, schools can use unlicensed spectrum for municipal or community Wi-Fi mesh networks.? Or, regulators can?allocate spectrum to deploy broadband wireless access technologies that use the school’s connection for?backhaul.?

In addition, if the school or its private-sector partner is able to develop a sustainable business model for charging even a nominal fee for Internet access, it can defray the ongoing cost of its own broadband connection.? Taking another approach, subsidized Internet access in communities can be used as a

tool to meet universal access goals, with broadband-connected schools as the enabling connection point.

[108]Comments of Microsoft Corporation, FCC GN Docket No. 09-40 and FCC GN Docket No. 09-51. https://portal.neca.org/portal/server.pt/gateway/PTARGS_0_0_307_206_0_43/http;/prodnet.www.neca.org/wawatch/wwpdf/68microsoft.pdf

4.3 Reaching disadvantaged populations

In addition to addressing broader educational and socioeconomic goals, the expansion of broadband connectivity to schools provides an important way?to address the unique needs of special populations such as women and girls, persons with disabilities, indigenous groups, special needs and rural or underserved groups.?

By extending broadband connectivity to schools, policymakers create centralized resources for providing resources tailored to the needs of these populations, whether they are sub-groups within larger schools or educational institutions dedicated to the needs of target populations.

For example, from 2001 to 2004, the Swedish telecommunications regulator, the PTS, was instructed to conduct pilot projects regarding access to bandwidth-intensive resources by persons with disabilities.[109]? One of the projects focused on the distribution of “talking books” to higher-education students with visual or reading impairments.? Specifically, the project involved enabling downloads of talking books from a central producer directly to university libraries – which then made the books available to students – as a replacement for postal delivery of such resources.

While the Swedish example was narrowly focused, it shows the role that educational institutions can play in expanding educational opportunities for?certain segments of the population.? Similar models – using schools as distribution or training points for access to targeted resources – could be employed to reach various sub-groups within a school population.

In addition, educational institutions that primarily serve particular sub-groups, such as women or girls, or indigenous populations, could benefit from collaboration and curriculum-sharing with other, similar institutions.? While such institutions may make up a small fraction of the schools in a given region, or even country, broadband connectivity allows educators and students at similar schools to share or

jointly develop curricula or projects focused on the particular needs of their populations.? Policymakers and educators are better able to justify the dedication of resources to curricula and institutions when the efforts will benefit larger populations, and broadband connectivity can transform multiple smaller populations into larger groups with similar needs.?

Broadening Teaching Possibilities

Further, in rural and remote regions, connecting schools to broadband enables a new generation of distance learning that goes far beyond traditional correspondence courses or broadcasting-based services.? Broadband enables services including videoconferencing, real-time distribution of classroom materials, and collaboration with students in the classroom and other distance learners.

An evaluation of an ICT for education project in Russia, carried out at the end of the 2007/08 school year, found that enrollment in distance learning courses increased by 75?per cent.? The?enrollment in rural?areas jumped from 2.4 per cent?to more than 30 per cent.? The big increase was due to Internet connectivity, which allowed students to take an online training course to prepare for the Unified State Examination. [110]

The common thread linking such initiatives is the broadband connection in the educational institution.? It?enables fast and cost-effective transmission of resources targeted at key populations, as well as sharing of content and curriculum?with other institutions?remotely located?students.

[109]See Broadband for people with disability, Post & Telestyrelsen, September 28, 2004. http://www.pts.se/upload/Documents/EN/2004_33_Broadband_for_people_with_disability.pdf.

[110]World Bank. IMPLEMENTATION COMPLETION AND RESULTS REPORT (IBRD-47260) ON A LOAN IN THE AMOUNT OF US$100 MILLION TO THE RUSSIAN FEDERATION FOR A E-LEARNING SUPPORT PROJECT IN SUPPORT OF THE FIRST PHASE OF THE GOVERNMENT'S EDUCATION MODERNIZATION PROGRAM. 30 December 2008

5 Cross-Cutting Issues

In the twnety-first century, the Internet has become a pervasive social, economic and cultural institution.? Its?influence is felt?in?every sphere of?public and private life -- including education.? Because the Internet itself does not exist in isolation,?initiatives?to extend connectivity to schools?are also affecting by several cross-cutting issues, including: (1) content and curricula?for schools, (2) teacher training, (3) assistive technologies for individuals with disabilities, (4) the availability of low-cost computing devices, (5) online?child protection and responsible behaviour, and (6) awareness?and capacity-building within the?targeted populations.??

5.1 Content and Curricula for Schools

Bringing broadband connectivity to schools is a first step.? Access to a broadband connection gives educators?a chance ?to significantly redesign curricula, making use of?newly available resources, research tools and student collaboration mechanisms.?

The availability of appropriate content and curricula fuels the incorporation of broadband-enabled resources into educational programmes.? There are?particular needs for?content addressing the interests and needs of, for example, women and girls, persons with disabilities, and indigenous people, among others.

Beyond educational settings, if content and tools are made available to address specific populations, there may be opportunities for the community as a whole to take advantage of?those resources, whether in a school-based telecentre setting, or through the longer-term benefits of meeting students'?needs as they grow into adult members of society.? Such opportunities not only meet specific?community needs, they?also?strengthen ties between the school and the community.

5.2 Training for Teachers

In concert with the development of educational content and curricula that leverage broadband connectivity, policymakers also need to ensure that resources are committed to training educators.?

Specifically, teachers need to understand how to locate appropriate resources online, how to make ICT-enabled content and activities an integral part of their curricula, and how to leverage applications that enable collaboration among students, among teachers and between the two groups. Training is also critical since broadband deployment cannot proceed if teachers are not ready to use it.

By providing initial and ongoing training for teachers, policymakers will enable educators to better understand the new resources available and to think more broadly about their application to classroom settings.

5.3 Assistive technology for persons with disabilities

The United Nations estimates that there are 500 million persons with disabilities around the world.[111]? Policymakers need to consider measures to give?these individuals?access to the broadband connectivity being offered to their peers.

This is a challenge, since the way broadband is offered needs to be relevant to the disability.? Furthermore, many persons with disabilities are illiterate, so it is essential that basic life skills training be provided as part of broadband initiatives, so that disabled individuals?can become independent and?fulfilled members of society.

Ideally, funding and planning for *assistive technology* will be incorporated as an integral component of ICT and education plans.? However, even in less-than-ideal planning exercises, policymakers and educators should identify technologies – both hardware and software, as appropriate – that enable students with disabilities to access online resources and participate in online collaborative environments.? In addition, assistive technologies can be employed to enable persons with disabilities to access existing resources that have previously been out of their reach, such as translation of textbooks into audiobooks.

Assistive technologies can include different types of input devices, such as large-type keyboards, specially designed monitors, text-to-audio and speech recognition applications, and even alternate workstation configurations to accommodate those unable to sit in traditional chairs.? In addition, funding for assistive technologies could include extending the learning environment outside the classroom or school.?

For example, Pakistan's universal service fund has initiated a programme to provide ICT-related equipment to visually impaired citizens.[112]? Although the project is not necessarily education-focused, it could serve as a model for bringing educational opportunities to those who may not be part of the general school population.

Telecom Portugal and Qualcomm are collaborating to fund pilot projects that use 3G mobile broadband technologies for persons with disabilities.[113] The idea of broadband connectivity is to improve educational opportunities and effectiveness for all students.? Using?assistive technologies ensures that this includes persons with disabilities.

[111]http://www.un.org/esa/socdev/enable/diswpa01.htm
[112]Masun, Noshid, "Universal Service Fund (USF) Pakistan's Special Project on ICT for Persons with Disabilities," presentation to Asia-Pacific Regional Forum on Mainstreaming ICT Accessibility for Persons with Disabilities, 26 August 2009, http://www.itu.int/ITU-D/asp/CMS/Events/2009/PwDs/docs/Session-5-Masud.ppt.
[113]http://www.qualcomm.co.uk/news/releases/2008/081203_Fundacao_Portugal_Telecom_and_Qualcomm_Collaborate.html

5.4 Low cost computing devices for schools initiatives

Governments and development partners around the world have implemented a wide array of initiatives to bring computers into schools.? Purchasing options range from the?centralized acquisition?of new computers by ministries of education to the donation of refurbished computers by non-governmental organizations.[114]? A frequent goal has been to reduce the ratio of students per computer in order for children gain more?computing time.

A recent trend has been the adoption of the "one-to-one" model, in which?each student gets?their own laptop. This movement has its roots in the vision of Nicholas Negroponte?(cofounder of the MIT Media Laboratory),?to provide every child with?an inexpensive laptop.? A prototype of such a?computer was shown at the World Summit on the Information Society in 2005.[115] Negroponte then founded the One Laptop Per Child (OLPC) association, which manufactures the low-cost XO computer, specifically designed for children in developing countries.[116]? Some 600,000 XO laptops have been ordered, delivered and/or deployed in some 30 countries around the world.[117] The biggest deployment has

been in Uruguay, which has committed to providing all of its primary school children with a laptop before the end of 2009.[118]

Some development agencies are playing a significant supporting role in the OLPC movement.? The Inter-American Development Bank (IDB) is providing funding support for pilots in Haiti[119] and Paraguay.[120] The United States Agency for International Development provides assistance for Afghanistan's OLPC project,[121] while the Danish government is assisting with funding an OLPC pilot in Nepal.[122]

The growing visibility of the one-to-one computing movement has attracted the attention of the electronics industry.? Semi-conductor giant Intel now offers a low-cost computer, the Classmate, intended for use in educational settings in developing nations.[123] The Classmate is being used for Portugal's *e-school* initiative, and Venezuela recently ordered one million of them.? The ASUS Eee Netbook, manufactured by a Taiwanese electronics company, has also been deployed for education in several countries, including a one million unit order for schools in Russia.? Brazil recently awarded a tender for 150,000 Indian-manufactured Mobilis laptops as part of its *One Computer per Student* programme.[124]

The relevance of these projects for school connectivity is that there is often a networking component involved. Most one-to-one deployments are designed to incorporate school computer servers connected to the Internet in order to download software, electronic textbooks and educational applications to the school laptops.? As a result, the low cost computing device movement is focusing increased attention on the necessity for school connectivity.

[114]One of the largest is UK-based Computer Aid International which has delivered around 150,000 refurbished computers to more than 100 countries. See: http://www.computeraid.org/

[115]"UN debut for $100 laptop for poor," BBC, 17 November 2005. http://news.bbc.co.uk/2/hi/technology/4445060.stm (accessed 5 August 2009).

[116]http://www.laptop.org.

[117]http://wiki.laptop.org/go/Deployments

[118]http://www.ceibal.edu.uy/

[119]http://www.iadb.org/news/detail.cfm?artid=4413&language=En&id=4413&CFID=1280276&CFTOKEN=76605445

[120]http://www.iadb.org/Projects/project.cfm?id=PR-T1081&lang=en

[121]http://afghanistan.usaid.gov/en/Article.540.aspx

[122]http://www.ambkathmandu.um.dk/en/menu/TheEmbassy/News/DanishsupporttoMinorProject.htm and http://www.ambkathmandu.um.dk/en/menu/TheEmbassy/News/DanishAmbassadorvisitsOLPCTestschool.htm

[123]http://www.classmatepc.com

[124]Cieglinski, Amanda, "MEC conclui pregão de compra do programa Um Computador por Aluno." *Agência Brasil*, 18 December 2008. http://www.agenciabrasil.gov.br/noticias/2008/12/17/materia.2008-12-17.8621960410/view (accessed 13 August 2009).

5.5 Promoting child online protection and responsible online behavior

While much attention is paid to expanding connectivity and access to online resources in educational settings, increased access to the Internet also brings risks, especially for young users.? Policies and plans to connect students to the Internet also need to consider measures to protect children from malicious actors and inappropriate content.? Children need to be taught?responsible online behavior.

The ITU's *Child Online Protection* (COP) initiative is working to address the relevant legal, technical, organizational, and procedural issues, and also to encourage capacity-building and international cooperation.[125]

Policymakers and educators need to strike a balance between implementing measures to simply block access to dangerous or sensitive materials or communities, and providing an online environment in which students can learn and exercise good judgment regarding safe and responsible computing.? Educational institutions continue to implement and refine Internet filtering software, even though such measures can stir controversy regarding censorship.? Moreover,?filtering guidelines can be subjective or ineffective.[126]

The ideal solution may be a combination of filtering the most objectionable or unsafe material and instructing educators and students on basic concepts of responsible computing.? This is particularly relevant given that students will not always be accessing the Internet behind school firewalls.??A solid foundation of safe computing behaviour?will allow students to apply the principles to new and evolving online environments.

[125]http://www.itu.int/osg/csd/cybersecurity/gca/cop/index.html

[126]In a recent example, a Japanese video game involving the apparent rape of school-age girls prompted calls that would ban possession of certain kinds of child pornography.? However, initial drafts of proposed legislation only addressed photographic images, not animations, such as those included in the video game. Matsutani, Minoru, “Anything goes in virtual pornography,” The Japan Times, 12 June 2009.

5.6 Awareness raising of targeted population and capacity building

One?key to realizing?the optimal benefits of broadband-connected schools is educating not only the administrators, teachers and students who use the technology, but also reaching out to those who do not.? The education of target populations should go beyond instruction in how to operate and interact with broadband-enabled resources.? There should?also be a more general effort to raise awareness of the educational and societal benefits of ICTs.

In particular, policymakers and educators should implement measures to increase awareness and adoption among the “offline” population by demonstrating the ways?broadband applications and services can be applied to their particular needs.??These might include?e-government services, research to improve agricultural production, or improved and?less-expensive communication with distant relatives.? In much the way that teachers and students can incorporate broadband-enabled applications and services into their curricula, the community at large can apply online information and resources to their own needs once they understand the available opportunities.

In addition, the target populations can be engaged to learn the skills that enable them to maintain and repair computers and network equipment.? Beyond the microeconomic impact of training individuals who could obtain paid positions providing technical support, a local base of support staff enables communities to be less-reliant on outside expertise, whether from a government, operator, vendor or NGO.? Local solutions enable community broadband access points to be self-sustaining,?reducing the likelihood that?equipment and connectivity will be lost if a key component fails.

6 Case Studies

This Section?features case studies about?school connectivity projects and experiences from different countries around the world. The examples underline?different approaches to school connectivity, including (1) establishing special?programmes to implement connectivity for?specific schools (Chile and Thailand); (2)?top-down and bottom-up methods?(Tunisia and Namibia, respectively); (3)?bringing together development partners and new technologies?(Macedonia);?and (4)?subsidizing Internet access tariffs for schools?(United States).? The case studies can be found at the following hyper-links:

--?Chile case study --The government of Chile has established the *Enlaces* programme to provide subsidized Internet access to the nation's schools.? Enlaces began work in primary and secondary schools in urban areas, but it expanded in 2000 to incorporate rural, less-accessible schools.? Enlaces has used several funding sources, including the nation's universal service fund, known as the *Fondo de Desarollo de Telecomunicaciones* (FDT).

-- Macedonia case study -- The *Macedonia Connects* project was established in 2004, as a partnership between the Macedonian education ministry and the U.S. Agency for International Development, although its roots extended back two years earlier with a donation of 5,000 computers from China. The culmination of this international effort was a record-breaking connection of all Macedonia's schools to the Internet between May and September 2005.

-- Namibia case study - Namibia's *SchoolNet* programme has taken a non-profit, non-governmental approach to providing sustainable Internet access in the country's schools. SchoolNet works with a range of partners, including the incumbent telecommunication operator and overseas development agencies, and provides open-source technologies and innovative connectivity solutions.

-- Thailand case study -- In Thailand, the government is working to build synergies between ICT facilities at the nation's universities and those in its primary and secondary schools. The effort in schools began with *SchoolNet*, which benefited from low Internet access rates set by the Telephone Organisation of Thailand. The Communication Authority of Thailand pitched in through low-cost international backbone access. Later, the government merged *SchoolNet* with a broader network, *EdNet*, which includes university coverage.

-- Tunisia case study -- Tunisia's dedication to education has translated into a priority effort to establish connectivity in its schools. Tunisia was the first African and Arab country to establish international backbone connectivity in 1991, and the country's president set a goal in 1997 to connect all schools to the Internet by the end of 2001. By 2006, 100 per cent of the 775 junior secondary schools were connected, as were 87 per cent of the 4,500 primary schools. Tunisia then began turning its attention increasingly toward expanding capacity and download speeds.

-- United States case study -- The U.S. approach has been to subsidize discounted service provided by private operators. The E-*Rate* programme underwrites discounts for telecommunication services provided to schools, libraries and other educational institutions. Operated in conjunction with the country's universal service fund, E-*Rate* spent more than USD 16 billion from 1998 to 2008. As a result, 100 per cent of American schools have Internet access, and 97 per cent have broadband connections.

7 Conclusion

School access to the Internet is considered an important policy for many countries. Benefits range from access to online education information, development of ICT skills and better school administration. In addition, the school Internet link can be leveraged to provide to provide access and training to the wider community.

Despite the recognized worldwide importance of Internet access for educational institutions, many developing countries are finding it extremely challenging to connect their schools. Though funding is typically cited as the main reason, there are a range of other bottlenecks including inexistent or unrealistic school connectivity plans and a lack of coordination between various stakeholders.? Prerequisite infrastructure such as electricity is often lacking, particularly in rural schools.

Though school connectivity requires substantial resources, there is evidence that the many potential funding sources available are not being adequately utilized. Funding is potentially available from a variety of sources including universal service funds, multilateral and bilateral donors, the private sector, non-governmental organizations as well as the parents of the students themselves.

The design of well-structured school connectivity plans with realistic timetables can have a big impact on increasing school Internet access throughout the world. These plans should be created with input from all stakeholders to achieve success, enhance coordination and ensure that potential donors are aware of them. The plans should also be tied to monitoring and evaluation tools so they can be modified and improved with experience in order to maximize their effectiveness. Though school connectivity cannot be achieved overnight, a plan with medium-, short- and long-term objectives can provide a roadmap to the day when the target will eventually be reached.

ANNEX 1: SCHOOL CONNECTIVITY CHECKLIST

SCHOOL CONNECTIVITY CHECKLIST

- In order to be more effective, school connectivity plans should be consistent with policies to promote?overall ICT connectivity within the country.? Within a national framework, school connectivity plans are best coordinated with policies, plans, strategies, and programmes for universal service,?as well as broadband and digital and Information Society agendas.
- There needs to be close coordination between the ministry responsible for education, the ministry responsible for ICTs, and the ICT regulator, to ensure that universal service funds and obligations are formulated within a plan for school connectivity that concretely describes the roles of all parties.
- School connectivity plans can also provide an important way?to address the connectivity needs of special populations, such as women and girls, persons with disabilities, indigenous peoples, rural or under-served populations and others?with special needs.
- A specific "ICT for education" plan is desirable, as it ensures that proper focus and detail is devoted to school connectivity, and that implementation targets are feasible and fundable.? A detailed ICT for education strategy is also essential to facilitate funding from development partners.
- The private sector and non-governmental organizations (NGOs) can play key roles in advancing school connectivity, and they should be invited to participate in the development of school connectivity plans.
- Key parameters to guide?and implement?the connectivity goals and targets?should be determined early in the plan development process.
- An inventory of school infrastructure and existing connections can assist in determining the potential for connectivity as well as the need for different connectivity models, based on?the circumstances of the school.
- Plans should identify the appropriate Internet connectivity technology or technology mix to provide an appropriate balance between available bandwidth and lower up-front and recurring costs.

- Subsidized Internet access?can be?a tool to meet universal access goals, with broadband-connected schools serving?as the enabling connection points.? Such funds could be established cooperatively between school connectivity programs and network operators.
- Government policies regarding spectrum allocation and use should take into consideration their impact on school connectivity
    - Allocation - Consider allocation of some portion of radio spectrum for educational broadband to ensure that schools can benefit from wireless communications
    - Reduced spectrum fees – Consider reducing or waiving spectrum fees for academic institutions
    - Unlicensed spectrum – Consider allowing use of unlicensed spectrum for broadband connectivity, reducing network deployment costs?compared with licensed wireless broadband options
- Modification of license obligations – Telecommunication network operator licenses can include specific conditions or requirements for the education sector, and regulatory authorities can consider modification of license conditions to include education-focused requirements
- Identification of potential funding sources – which may include governments, operators, multilateral or bilateral assistance, and private sector sources – is crucial to determining the potential reach and impact of school connectivity plans.
- Monitoring and evaluation?plans should include methods to evaluate the technical results of Internet connectivity, measure progress towards school connectivity and analyze the impact of broadband access on learning.?
- Monitoring and evaluation should be employed for both new deployments as well as upgrades from narrowband to broadband connectivity.? Metrics for measuring deployment often include tracking the number of primary and secondary schools with Internet access (broken down by narrowband and broadband access and public and private schools) and comparing that figure to targets set within a plan.
- Preferential tariff agreements – School connectivity initiatives can include negotiating agreements with operators to obtain?preferential fees?and prices for educational facilities.
- Policy makers should consider the potential for extending connectivity in a locality once an Internet point at a school has been established.? Broadband-connected schools can be viewed as regional “hubs” or “anchor points,” from which broadband connectivity – perhaps at a lower throughput than that delivered to the school – can be shared with the surrounding community.

Credits

The Module on Policies and Regulation to Promote School Connectivity was drafted by Telecommunications Management Group, Inc. (TMG) a highly regarded international consulting firm providing regulatory, economic, market, and financial advisory services in the telecommunications and information technology sector. TMG is comprised of a team of regulatory experts, lawyers, economists, market analysts, financial specialists, engineers, and spectrum management experts. Its senior consultants, many of whom are former government policymakers and regulators, have up to 30 years of experience in the international telecommunications industry and collectively have worked on telecommunications regulatory projects over 50 countries in Africa, the Americas, Asia, Europe and the Middle East. More information on TMG can be found at www.tmgtelecom.com.

Reference Documents

- Bahamas: Telecommunications Sector Policy
- Botswana: National Information and Communications Technology Policy
- Brazil: Institution of a National Program for Rural Telecommunications
- Canada: Connectivity and ICT Integration in Elementary and Secondary Schools
- Chile: Agreement between the Government and CTC
- Chile: Indicators of Digital Network Infrastructure
- Ecuador: Universal Service Plan
- Enlaces: 15 Years of Integrating Technology into Chile's Education
- Europe: Benchmarking Access and Use of ICTs in European Schools
- European Union: eEurope 2002 Final Report
- European Union: eEurope 2005 - An Information Society for All
- European Union: eEurope Initiative Objective 2
- Latin America and Caribbean Countries: Rio de Janeiro Commitment
- Latin America and the Caribbean: San Salvador Commitment
- Latin America and the Caribbean: San Salvador Commitment
- Malaysia: Case Study on ICT Integration into Education
- Pakistan: National Information and Communications Technology Strategy for Education
- Peru: Political Efforts to Promote Mass Availability of the Internet
- Philippines: Launching the DepEd Internet Connectivity Project
- Philippines: Launching the DepEd Internet Connectivity Project
- Philippines: Mid-Term Philippine Development Plan, Chapter 18
- Plan of Action for the Information Society in Latin America and the Caribbean (eLAC 2007)
- Russia: Implementation Completion and Results Report
- Sri Lanka: Secondary Education Modernization Project
- Sri Lanka: Secondary Education Modernization Project
- Survey of ICT and Education in Africa
- Sweden: Broadband for People with Disability
- The NEPAD e-schools Initiative
- United Nations: MGD Goal 2 -- Achieve Universal Primary Education
- United Nations: Goal 3 -- Promote Gender Equality and Empower Women

- United States: Evaluation of Evidence-Based Practices in Online Learning
- United States: Internet Access in U.S. Public Schools and Classrooms, 1994-2005
- United States: USTDA Proposal and Budget Model Format
- World Summit on the Information Society: Plan of Action
- World Summit on the Information Society: Tunis Commitment

Case Studies

- 6.1 Enlaces in Chile
- 6.2 Macedonia connects
- 6.3 SchoolNet Namibia
- 6.4 From SchoolNet to EdNet in Thailand
- 6.5 Top-down in Tunisia
- 6.6 The E-Rate in the United States