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Updated Module 1: Policies and Regulation to Promote School Connectivity

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Module 1: Policies and Regulation to Promote School Connectivity

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 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 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 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.


### 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.

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.

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.

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”
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 Millennium Development Goals (MDGs), (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.
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. 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.

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 on developing policies for improved educational accessibility. 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.”

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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) 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.  

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. It also recommended removing gender barriers to ICT education and empowering ICT use in rural and underserved communities. 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." 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.

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." 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.
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:

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 children 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.

The EFA goals are monitored on an annual basis by UNESCO. 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.


2.2 Regional initiatives

Some initiatives to achieve school connectivity are international, but not necessarily global. These initiatives 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.

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. 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.


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.

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


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.


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

\[
\text{Member States [to] ensure that all schools in the Union have access to the Internet and multimedia resources by the end of 2001.}^{28}
\]

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, 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

<table>
<thead>
<tr>
<th>Country</th>
<th>Total</th>
<th>Narrowband Internet access</th>
<th>Broadband Internet access</th>
<th>Schools in densely populated areas</th>
<th>Schools in intermediate areas</th>
<th>Schools in thinly populated areas</th>
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Base: All schools of the respective breakdown category and country.
Question: G9: By which of the following means does your school mainly have access to the internet?
Wording: G9: % of schools stating at least one type of internet connection.
Indicator: xx.x% based on at least 50 cases.
Source: empirica: LearnInd 2006 (HTS)

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

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.  

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. 

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. 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.

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 various 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
<table>
<thead>
<tr>
<th>Country</th>
<th>ICT for Education Policy</th>
<th>Source</th>
<th>School connectivity goal [Timetable]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolivia</td>
<td>National Policy for New Information and Communication Technologies for Schools (2005)</td>
<td>Ministry of Education</td>
<td>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 accomplishing the goals]</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Policies and Strategies on Information and Communication Technology for Education in Cambodia (2004)</td>
<td>Ministry of Education, Youth and Sport</td>
<td>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]</td>
</tr>
<tr>
<td>Namibia</td>
<td>ICT Policy for Education (2005)</td>
<td>Minister of Higher Education, Training and Employment Creation; Minister of Basic Education, Sport</td>
<td>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.”]</td>
</tr>
</tbody>
</table>

CONNECT A SCHOOL, CONNECT A COMMUNITY
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. 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.

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 kind 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 be 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**

<table>
<thead>
<tr>
<th>APPROACH</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
</table>
| **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 a 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 |
<table>
<thead>
<tr>
<th>APPROACH</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
</table>
| Hybrid           | • Involves schools in implementation of connectivity and usage of ICTs in education  
|                  | • Provides guidance and consistency on technical solutions                  | • Local schools may not have a sufficient understanding of the benefits of Internet access and use of ICTs in education |
|                  | • Makes schools focus on specific needs and how to meet those needs         | • Local schools may lack personnel qualified to manage new technologies      |
|                  | • Can ensure funds are available                                             | • Schools may not be aware of the availability of funds for connectivity     |
|                  | • School selection more transparent                                          | • Schools that do not meet requirements remain unconnected                  |
| Bottom-Up        | • Schools that have resources can implement connectivity without delay      | • Schools do not benefit from economies of scale                             |
|                  | • Schools can select solutions that are appropriate to their circumstances  | • Integration of local connectivity solutions into eventual government-wide plan becomes more complex |
|                  | • Some development partners are willing to fund smaller pilot projects rather than large-scale programs |                                                                                 |
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% 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?
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. 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**

Source: UNESCO Institute for Statistics, *A View Inside Primary Schools: A World Economic Indicators (WEI) cross-national study, 2008*
Schools serving specific groups, or in particular locations, have been targeted for special school connectivity programs in some countries. In Canada, the First Nations 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. 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.”

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

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. 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).

**Table 3-4: Timetable for Morocco’s GENIE Program**

<table>
<thead>
<tr>
<th>Year</th>
<th>Primary</th>
<th>Junior secondary</th>
<th>Secondary</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>%</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Number of schools</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Year 2</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>%</td>
<td>?</td>
<td>?</td>
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</tr>
<tr>
<td>Number of schools</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Year 3</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
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<tr>
<td>%</td>
<td>?</td>
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<td>?</td>
</tr>
<tr>
<td>Number of schools</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Total</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
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<tr>
<td>%</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Number of schools</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

???????? 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). 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.
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. 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.” 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;

- Ireland: 100 Mbps for post-primary schools;

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

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, or third generation mobile or satellite Internet access are possibilities wherever fixed lines are unavailable. 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
<table>
<thead>
<tr>
<th>Technology</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dial-up</strong></td>
<td>Most common narrowband connectivity option; uses existing telephone network. Can incur significant costs if telephone usage charges must be paid.</td>
</tr>
<tr>
<td><strong>ISDN</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>GPRS</strong></td>
<td>Mobile technology using GSM networks providing narrowband access at speeds roughly similar to dial-up.</td>
</tr>
<tr>
<td><strong>EDGE</strong></td>
<td>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})</td>
</tr>
<tr>
<td><strong>W-CDMA</strong></td>
<td>A third-generation (3G) mobile technology providing speeds up to 384 kbps.</td>
</tr>
<tr>
<td><strong>HSDPA</strong></td>
<td>A broadband 3G mobile technology.</td>
</tr>
<tr>
<td><strong>EV-DO</strong></td>
<td>A 3G mobile cellular broadband technology based on CDMA2000. Being used to connect schools in Guatemala and Indonesia.(^{54})</td>
</tr>
<tr>
<td><strong>DSL</strong></td>
<td>Used by schools in a number of countries. Requires telephone line connection.</td>
</tr>
</tbody>
</table>

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
<table>
<thead>
<tr>
<th>Technology</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable modem</td>
<td>Provides broadband over cable television networks. Not widely deployed in developing countries.</td>
</tr>
</tbody>
</table>
### 3.3.2 School network topology

Several options exist to deliver 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. 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

![Chart showing Internet availability in subsidized Chilean public schools by type of access from 1998 to 2007.]

Source: Enlaces.

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.

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 underserved 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.\(^6^2\) 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.\(^6^3\)


### 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.\(^6^4\) 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:

CONNECT A SCHOOL, CONNECT A COMMUNITY connectaschool.org
(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.


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. 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.


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. 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.
3.5.2.3 Unlicensed spectrum

Unlicensed spectrum refers to radio frequency bands that may be used without a licence. 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. 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.

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


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.

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.

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.

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. The implementation of these obligations depends on the Ministry of Education acting to identify the schools to be connected.


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. In the Maldives, incumbent operator Dhiraagu provides lower broadband tariffs to schools through a special arrangement with the Ministry of Education.


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 multiple 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 are multiple sources of funding 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 publicly 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 per cent of these have access to broadband. In 2008, 2,644 schools were granted funds for broadband Internet connectivity.
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.\(^7\)


\(^\text{76}\)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**
<table>
<thead>
<tr>
<th>Country</th>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belize</td>
<td>Belize Telemedia Limited (BTL)</td>
<td>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.</td>
</tr>
<tr>
<td>Chile</td>
<td>Compañía de Telecomunicaciones de? Chile (CTC)</td>
<td>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.</td>
</tr>
<tr>
<td>Germany</td>
<td>Deutsche Telekom</td>
<td>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 schools, about 30,000 have a DSL broadband connection.</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>Slovak Telekom</td>
<td>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.</td>
</tr>
<tr>
<td>Uruguay</td>
<td>Antel</td>
<td>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.</td>
</tr>
</tbody>
</table>
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. 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.” 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.\textsuperscript{85}

- The Asian Development Bank helped to fund the \textit{Sri Lanka Secondary Education Modernization Project}, which ran from 2000 to 2007.\textsuperscript{86} The project included a component for creating over 1,000 "computer learning centres" in secondary schools.\textsuperscript{87} The centres include Internet access.

- The Inter-American Development Bank (IDB) has a long history of supporting school connectivity in Latin America and the Caribbean.\textsuperscript{88} It has provided assistance for various school connectivity projects in countries such as Argentina, El Salvador, Nicaragua and Trinidad and Tobago.\textsuperscript{89} Along with the Caribbean Development Bank, the ADB provided funding for the Barbados \textit{Education Sector Enhancement Programme} (EduTech), which led to Internet access for all primary and secondary schools.\textsuperscript{90} In addition, the IDB is assisting with funding of several school computer programs that have a connectivity component.\textsuperscript{91} In Haiti, the \textit{One Laptop per Child Model Project} includes funding for connectivity.\textsuperscript{92} 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 \textit{SchoolNet} project, which supports pilot school connectivity projects in Cambodia, Indonesia, Laos, the Philippines and Vietnam.\textsuperscript{93}

- The Swedish International Development Cooperation Agency (SIDA) has provided ongoing financial assistance to Namibia’s \textit{SchoolNet} project, which provides Internet access to schools.\textsuperscript{94} SIDA has contributed close to NAD 23 million (USD 2.9 million) since mid-2001.

- The United States Agency for International Development (USAID) has provided assistance to school connectivity projects around the world.\textsuperscript{95} For example, it helped fund the \textit{Macedonia Connects} program, which led to the provision of wireless broadband access to all of that country’s primary and secondary schools.\textsuperscript{96} It also helped with financing of a high school connectivity project in Yemen, with a focus on girls’ access to ICTs.\textsuperscript{97}
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.
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.

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

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.

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.
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

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. 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.
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

<table>
<thead>
<tr>
<th>Date</th>
<th>Primary</th>
<th>Secondary</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of schools</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Total number of students</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Number schools with Internet access</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Number of schools with broadband Internet access</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Number of students covered by Internet access</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Number of students covered by broadband Internet access</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

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, 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.\textsuperscript{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.\textsuperscript{104} 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.\textsuperscript{104}

\textsuperscript{100}Intel Corporation, “Deploying 1:1 e-Learning Environments for the 21st Century,” 2007


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.

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. 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.


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. 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.


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. 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.
5 Cross-Cutting Issues

In the twenty-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. 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. 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. 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.

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. 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. Negroponte then founded the One Laptop Per Child (OLPC) association, which manufactures the low-cost XO computer, specifically designed for children in developing countries. Some 600,000 XO laptops have been ordered, delivered and/or deployed in some 30 countries around the world. 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.

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 and Paraguay. The United States Agency for International Development provides assistance for Afghanistan’s OLPC project, while the Danish government is assisting with funding an OLPC pilot in Nepal.

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. 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.

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.

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/


http://wiki.laptop.org/go/Deployments
http://www.ceibal.edu.uy/
http://www.iadb.org/Projects/project.cfm?id=PR-T1081?=en
http://www.classmatepc.com


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.\(^\text{125}\)

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.\(^\text{125}\) Educational institutions continue to implement and refine Internet filtering software, even though such measures can stir controversy regarding censorship.\(^\text{126}\) Moreover, filtering guidelines can be subjective or ineffective.\(^\text{126}\)

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.\(^\text{126}\) This is particularly relevant given that students will not always be accessing the Internet behind school firewalls.\(^\text{126}\) A solid foundation of safe computing behaviour will allow students to apply the principles to new and evolving online environments.


\(^{126}\) 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.\(^\text{126}\) 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.\(^\text{126}\) The education of target populations should go beyond instruction in how to operate and interact with broadband-enabled resources.\(^\text{126}\) 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 Desarrollo 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.
Module 2: Disseminating Low-Cost Computing Devices in Schools

1 Introduction

A growing number of governments around the world are investigating and implementing pilots or programs to distribute low-cost computing devices (LCCDs) for schools in their countries. The potential LCCD market is vast. According to Intel Corporation, "There are 1.3 billion school-age children around the world, and of those, only five per cent have access to a PC..."¹ This toolkit module examines the LCCD arena, analyzes costs, identifies implementation issues, and reviews different countries' experiences with LCCD programs.

More specifically, Section 2 defines LCCDs and provides examples of devices that are currently being tested and deployed in school projects around the world. Section 3 identifies the various cost elements involved in LCCD deployments. In addition to the LCCD itself, there are other items that must be considered in implementing an LCCD project, including electricity, networking, software, training, transport, and distribution and maintenance.

Section 4 examines implementation details, such as coordinating LCCD programs and deciding which schools and students should receive LCCDs. Section 5 provides several case studies about LCCD deployments in different countries around the world. There is also a "checklist for planning and implementation of an LCCD project.

2 What Are Low-Cost Computing Devices

Low-cost computing device is a relative term, given the wide differences in economic development around the world. A USD 100 difference in the price of a computer may not seem significant in a developed country, but it can make an enormous difference in a developing country. For example, in Benin, “…the cost of a generic PC is equivalent to a teacher’s salary for eight months.”

The cost of computers has influenced national strategies for introducing information technology in schools. The typical way to reduce expenses has been to install a “computer lab” -- a shared location in the school where a few computers can serve multiple students. A strategy for many countries has been to increase the number of such labs, introducing them into schools that previously had no computers. For instance, in 2003 Indonesia adopted its “One School One Lab” program aimed at expanding the availability of computer labs in its educational institutions.

Another strategy has been to reduce the ratio of students to computers. Take Chile, for example, where the number of students per computer dropped from 70 in the year 2000 to 26 in 2007, with the government aiming for 10 students per computer by 2010. Lower-cost computers make it more affordable for countries to distribute them widely in schools.

To many researchers, academics, development specialists and government officials, a low-cost computing device is a specific concept, grounded in a philosophical context. The idea behind low-cost computing devices developed from then-MIT Lab researcher Nicholas Negroponte, who articulated a vision of an inexpensive laptop for every child in the world.

A prototype of the computer was shown at the World Summit on the Information Society (WSIS) in 2005. Describing the benefits of LCCDs, former UN Secretary-General Kofi Anan said, "Children will be able to learn by doing, not just through instruction. They will be able to open up new fronts for their education, particularly peer-to-peer learning." He added that the idea was inspiring, with real potential for students’ social and economic growth in developing countries.
One important distinction is the difference between “one lab per school” and “one computer per student.” Policies for introducing computers in schools have traditionally revolved around labs, with a number of students sharing one computer. The low-cost computer device movement is oriented toward each student having his or her own laptop:

“The mission of the One Laptop per Child (OLPC) movement is to ensure that all school-aged children in the developing world are able to engage effectively with their own personal laptop….”

“The ultimate goal is to reach the point where there is one laptop for each student…”

The one-to-one concept gives pupils more time on the computer than in a shared, lab-type environment. A calculation carried out for the Nepalese government found that a computer lab user only spends 1% per cent of the time on a computer that a student with a LCCD spends. The Solomon Islands initially explored providing each school with a computer lab, but with LCCDs, “…an even better outcome was ensured, as every child and teacher would have a laptop.”

Used computers can also be considered low-cost computing devices. Although there are costs involved with recycling, the computer itself is generally donated for free. Furthermore, some argue that recycled computers can be cheaper than low-cost laptops when all of the costs are factored in, including waste and social benefit to the country. A study on the sustainability of computers for schools in Colombia suggests that used computers that are refurbished in the beneficiary country have the highest “utility,” which factors in involvement of the local economy, creation of jobs and the environment.

Another model for reducing the cost of computers in schools is the “thin-client” approach, in which a simple computer (the “client”) is connected to a server that carries out most of the processing. This is similar to the environment that existed in the pre-personal computer era, when terminals were connected to host computers. This model is attractive from a cost perspective, since thin clients are cheaper than conventional computers. It is also attractive for a school environment, where a teacher
has more control over the computer learning environment. This solution has been used in rural schools in Brazil, where the cost per workstation is around USD 50.\textsuperscript{12}

While one-to-one computing is attractive, it is an expensive proposition. Using the figures referred to earlier, the cost of outfitting 1.3 billion developing-country students with their own laptops would be more than USD 100 billion. This assumes a USD 100 cost for the laptop and does not take into account all of the other associated costs, such as transport, distribution, maintenance and training.

The advantages and disadvantages of different approaches—one-to-one computing or computer labs—are shown in the table below. Given the high cost of providing each student with their own laptop, this is not a feasible short-term approach for many developing countries, and a more practical strategy may be a mix of approaches.

Table 2-1: Pros and Cons of Computer Labs and One-to-One Computing

<table>
<thead>
<tr>
<th>Model</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>One computer per student (laptops)</td>
<td>• Can be taken home and shared with family</td>
<td>• Relatively Expensive</td>
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<tr>
<td></td>
<td>• Creates sense of ownership with less theft and damage</td>
<td>• Can be disruptive</td>
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<tr>
<td></td>
<td>• Some designed for developing country rural environment (e.g.,</td>
<td></td>
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<td></td>
<td>handle extreme temperatures, low battery use, etc.)</td>
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<td></td>
<td>• Some designed for children (e.g., rugged, ergonomic)</td>
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<td></td>
<td>• Some include educational software and ecosystem of support</td>
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<td></td>
<td>• More democratic in that all children receive computers</td>
<td></td>
</tr>
<tr>
<td>Computer labs (recycled computers, thin</td>
<td>• Less disruptive than one-to-one model</td>
<td>• Higher maintenance and support since</td>
</tr>
<tr>
<td>clients)</td>
<td>• Computer lab more economical than one-to-one</td>
<td>likely to be different?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students spend less time with computer</td>
</tr>
<tr>
<td>More practical for shared settings such as computer labs or community centres. Generally more powerful than laptops</td>
<td>Labs may not be equitably distributed throughout school system or computers can be dominated by certain students</td>
<td></td>
</tr>
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</table>

2.1 LCCDs for Education

Initially, low-cost computing devices were considered to be laptops with rugged construction and low power consumption that were specifically designed for students in developing countries. However, several computer manufacturers now offer laptops that have similar features, although they have not been designed solely for the educational market. The main commonalities of LCCDs, regardless of the
brand or specific functionality, are a relatively low price (less than USD 300 for the device), laptop form factor and small size (e.g., screen size less than 10 inches)?

Leading examples of LCCDs include:

• XO – A laptop developed by One Laptop Per Child (OLPC), the XO is specifically designed for primary school students in developing nations, and it has a range of features appropriate to that environment. The XO’s design has factored in technological issues such as local language support, as well as environmental conditions such as high heat and humidity. In order to minimize malfunctions, it has no movable parts (e.g., no hard disk or fan), and it features special antennas to support mesh networking.

The XO is backed by a large ecosystem of system designers, education experts and development specialists. The educational theories are tied into the operating system and software included with the XO. Dozens of nations are piloting or carrying out large-scale XO implementations. Some of the most significant are Uruguay, where the government has provided XO laptops to all public school primary students, and Rwanda, which, in addition to distributing XOs to schools, is also emerging as a research and training center for the XO.

• Classmate – A laptop developed by semiconductor manufacturer Intel as a “mobile personal learning device for primary students in emerging markets.” Originally introduced in 2006, the second-generation Classmate is built around an Intel processor and has a rugged, “kid-friendly” design. Features include hardware-based theft protection, Wi-Fi and a battery life of between 3.5 to 5 hours. The Classmate runs Windows XP or Linux and is available in clamshell or convertible designs. Intel has licensed the technology to various manufacturers.

One of the largest deployments of Classmate is in Portugal, which has contracted around half a million of these laptops. The Classmate is used for the country’s Magalhães initiative (“Magellan” in English, named after the Portuguese navigator). Local company JP Sá Couto manufactures the computers. Portugal is leveraging the program to spread Magellan Classmates to developing countries. In September 2008, it signed a deal with the Venezuelan government to supply one million Portuguese-manufactured Classmates. The country’s incumbent telecommunications operator,
Portugal Telecom, has targeted the Magellan for overseas social responsibility programs, with plans to distribute the laptop in Lusophone Africa\(^\text{19}\) and Namibia.\(^\text{20}\)

- Netbooks -- Encouraged by the LCCD movement for students, computer makers have been downsizing laptops to also tap into the market (e.g., netbooks). A noteworthy one in terms of price and entry into the educational market is the Asus Eee.\(^\text{21}\) Asustek, a Taiwanese computer manufacturer, has developed rugged portable computers for use in space, off-road races, Mount Everest and the North and South Poles.\(^\text{22}\) It introduced the Eee PC notebook in October 2007. The Eee, like the XO and Classmate, is a portable laptop that uses flash drive storage, and the entry-level models are price-competitive. But the Eee was not strictly designed for the educational environment as were some other devices. As with other commercial computers, it comes in a much wider range of configurations and models than the Classmate or XO.

One of the largest Eee educational deployments is in Russia, where it is being used in schools following an order for approximately USD 200 million from the Free Deed Foundation, a philanthropy organization. The purchase of some 1 million Eee PC 700 models is to be delivered over the next five years.\(^\text{23}\) The Eee has also been deployed in various school projects in the United States.\(^\text{24}\) It also emerged as the preferred LCCD in testing done at three African universities (it should be noted, however, that some LCCDs such as the OLPC XO or Intel Classmate are not designed for university students).\(^\text{25}\)

- Mobilis -- Another LCCD that may become the focus of greater attention is the Mobilis, manufactured by the Indian company Encore.\(^\text{26}\) The Mobilis was recently selected in a tender for school laptops in Brazil.\(^\text{27}\) Yet another is the Israeli-designed ITP-C, which is being used in school projects in Argentina and Chile.\(^\text{28}\)

**Figure 2-1: Low-Cost Computing Devices Used in Schools**
Note: The list of countries where the devices are used in schools excludes developed nations.


15 The theft protection links the Classmate to a school server. If the Classmate loses connection to the server for a certain period of time, it is rendered unusable and can only be reactivated if returned to the school. See: http://blogs.intel.com/technology/2009/08/classmate_pc_as_a_one-to-one_l.php

16 http://www.intel.com/pressroom/archive/releases/20080730corp.htm

17 http://www.magalhaes.gov.pt
3 Low-Cost Computing Device Cost Elements

There are a variety of direct and ancillary costs involved in the implementation of a low-cost computing program. The initial costs include the LCCD hardware, software licenses (if not included with the LCCD itself), as well as certain peripherals (printers, additional memory, etc.), network access, and development of content specifically for the LCCD program.

Other costs involve taxes, as well as the transportation and distribution costs related to the deployment of the LCCDs. The size of the country can impact those distribution and transportation costs. A smaller, more urbanized, country will have lower costs than a large, rural one.
The training of children and teachers on how to use the LCCD is another initial, ancillary cost. These are also a variety of ongoing costs related to an LCCD program. These include costs related to the maintenance of computers, software upgrades, security, ongoing network access costs, electricity, and staff costs, if applicable.

The above-mentioned initial and ongoing costs will vary substantially, depending on the scope of the program. Some projects are national (e.g., hundreds of thousands of LCCDs for a nationwide implementation in Uruguay) whereas others are more localized (e.g., a 30 LCCD pilot in Mali). The magnitude of the LCCD implementation has economy-of-scale implications for various elements, such as the price of the LCCD.

The software that comes with the LCCD, along with government policies for applications and educational content, impacts software costs. Some countries may find that the applications that come with the LCCD are sufficient for their needs while others may want to use freely available applications that can be downloaded from the Internet or purchased commercially. In terms of educational content, there are hundreds of free packages.

Content is already available in some countries, even if it sometimes must be modified to run on the LCCDs. Brand-new content may need to be developed in other countries. Some costs can be internalized, such as training or content development. In other words, rather than requiring additional government educational expenditures, elements of the LCCD project may have no impact on budgets if the activities already exist in government school systems. For example, there may already be a content development center for computers. Governments might be able to transfer funds from educational activities that are no longer a priority to new LCCD projects.

Given this diversity in scope, it is possible to anticipate the necessary cost elements, but difficult to provide specific costs associated with these cost elements, since this will vary significantly based on the scope of the program and the country in which the program is being deployed.

3-1: LCCD cost elements
3.1 Infrastructure

Infrastructure refers to the ICT hardware and other infrastructure components typically required for an LCCD program. Apart from the cost of the LCCD itself, other physical elements need to be factored into an LCCD program, including peripheral components for the LCCD, networking, servers, and electricity.

3.1.1 The Low-Cost Computing Device

Although one of the goals of the one-to-one computing movement was a USD 100 laptop, this has yet to be achieved. LCCD costs vary depending on brand, configuration and the number purchased. The unit prices of various LCCDs are shown in the table below. This assumes the purchase of a single unit with a default configuration and does not reflect volume discounts. Prices range from USD199.99 to USD 299.99.

<table>
<thead>
<tr>
<th>Type of LCCD</th>
<th>Price (USD)</th>
<th>Remark</th>
</tr>
</thead>
</table>

Table 3-1: Unit Price of Various LCCDs
Furthermore, because many LCCD projects are still pilots using donated equipment, it is difficult to get a firm figure about the price of LCCDs. At the same time, large-scale implementations have typically involved many other cost elements, also making it difficult to isolate just the LCCD cost.

Another perspective on the costs of the LCCDs is to look at project costs in various implementations around the world. One difficulty is that they typically include other items besides just the LCCD. However, the resulting price per LCCD is still cheaper than average per-unit prices and thus provides an insight into the impact of volume discounts.

**Table 3.2: Cost of LCCD Programs in Various Countries**

<table>
<thead>
<tr>
<th>Country</th>
<th>Date</th>
<th># of LCCDs</th>
<th>Total (USD million)</th>
<th>Price per LCCD (US$)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>Dec-08</td>
<td>150,000 (Mobilis)</td>
<td>USD 35.2</td>
<td>USD 235</td>
<td>Including delivery to schools, taxes, 12 month guarantee, maintenance and equipment configuration.</td>
</tr>
<tr>
<td>Haiti</td>
<td>Feb-08</td>
<td>13,700 (XO)</td>
<td>USD 5.1</td>
<td>USD 372</td>
<td>Including training, electricity, content development and networking. LCCDs valued at US$146.</td>
</tr>
<tr>
<td>Russia</td>
<td>?</td>
<td>1,000,000 (Eee)</td>
<td>USD 200</td>
<td>USD 200</td>
<td>Information is not available about what this amount covers.</td>
</tr>
<tr>
<td>Uruguay</td>
<td>Oct-07</td>
<td>100,000 (XO)</td>
<td>USD 19.9</td>
<td>USD 199</td>
<td>Including servers, guarantee, delivery to Montevideo and network-ready.</td>
</tr>
</tbody>
</table>
3.1.1.1 Additional Hardware Components

All of the LCCDs described in Section 2 come with a number of features, such as Wi-Fi network capability, integrated cameras and microphones, etc., and are ready to use as-is. Additional components for the LCCDs might be needed, however, depending on what each government deems necessary. These primarily revolve around storage, connectivity and peripherals.

- **Storage**: Most LCCDs used for education come with flash drives rather than hard disks. The capacity of the drives varies. If the storage is deemed insufficient, then the cost of obtaining higher capacity flash drives would need to be factored into the unit cost. Extra storage could also be supported through a school server.

- **Connectivity**: All of the LCCDs come with Wi-Fi connectivity. However, in order to connect to the Internet, access points need to be provided. This is discussed under Servers below. In addition, most LCCDs do not include Bluetooth connectivity, so if that is deemed important, then the cost of Bluetooth adapters would need to be included.

- **Peripherals**: Printers and scanners might also be needed.

The table below provides some indicative prices for additional hardware devices that might be needed.

<table>
<thead>
<tr>
<th>Product</th>
<th>Brand</th>
<th>Price (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluetooth Adapter</td>
<td>Bluetooth USB 2.0 Micro Adapter Dongle</td>
<td>1.75</td>
</tr>
<tr>
<td>USB Flash Drive</td>
<td>SunDisk Cruzer 4/8/16</td>
<td>7.93/17.39/29.90/67.72</td>
</tr>
<tr>
<td>Printer/Scanner</td>
<td>Epson NX400 all-in-one Printer</td>
<td>59.95</td>
</tr>
</tbody>
</table>

Note: Lowest price brands (excluding tax) for each product according to Amazon USA (accessed August 2009).
3.1.1.2 Taxes

Import duties, Value-Added Taxes (VAT) and other taxes add to the cost of procuring an LCCD, as well as other supporting equipment. Policies vary widely regarding the extent to which these taxes are applied.

The World Trade Organization’s *Ministerial Declaration on Trade in Information Technology Products* (ITA) was agreed to by 29 participants in 1996. The number of participants has since grown to 70, representing about 97 per cent of world trade in information technology products. The ITA calls for the total removal of import duties on ICT goods. Many developing countries, the targeted group for most LCCD projects, have not signed the ITA. Nonetheless, some countries have eliminated import duties on computers even though they are not ITA signatories.

Import duties are sometimes used to encourage local assembly, refurbishment or manufacturing. In Brazil’s government auction for LCCDs, one of the alleged reasons OLPC had higher costs than its competitors was because it had to include the cost of import duties. Some other bidders were offering domestically produced computers. In Colombia, imported LCCDs have been rejected as the lowest-cost solution for schools because they do not add as much to the economy as domestically refurbished computers.

Therefore, the impact of taxes on the LCCD program will vary from country to country. As noted, import duties are not an issue in countries that have abolished duties on information technology equipment. VAT also may not be applicable if the computers are shipped directly to the government instead of going through a third party.

3.1.1.3 Security

Security costs must be contemplated in order to minimize the theft of the LCCDs. Both the XO and the Classmate have built-in security features, reducing the need for additional expenditures. The
Classmate has hard-wired anti-theft features,\(^{30}\) while the XO uses software-based security.\(^{31}\) While these systems will generally render the LCCD unusable for unauthorized users, they may not be sufficient to reduce physical thefts, particularly if the thief is not aware of these features. Having students take the LCCD home at night can reduce security costs. Conversely, having a locked or guarded location to store the LCCDs should be considered.


\(^{31}\) [http://wiki.laptop.org/go/Bitfrost#Current_Status](http://wiki.laptop.org/go/Bitfrost#Current_Status)

### 3.1.1.4 Transport

Transportation can form a significant part of the costs of providing low-cost computing devices. LCCDs need to be transported from the manufacturing location to the destination country. Each country’s costs for distribution of LCCDs will vary tremendously, depending on the distance from the LCCD manufacturing locations and the breadth of deployment, as well as the shipping method. Once in the country, the LCCDs then must be transported to different schools.

Priorities will dictate whether to use air or surface transportation. The former is more expensive (items are typically priced by weight) but quicker, whereas surface shipping is less expensive (items typically are priced by volume). There may additional costs if the LCCDs need to be assembled or reassembled once in the country. All of these factors make it difficult to provide a common figure for transport costs.

Transportation problems impact the LCCD program. For example, in the Solomon Islands, laptops could not be distributed to some schools because of logistics, and some teachers could not be briefed on the project because of a lack of fuel to transport them.\(^{32}\)

\(^{32}\)
3.1.1.5 Adaptation for the Disabled

Since most LCCD projects are still pilots with few large-scale deployments, limited resources have been directed at making them usable for disabled children. Nonetheless, certain countries, such as Portugal, Russia and Uruguay, have introduced measures to make LCCDs accessible for those individuals.

For example, an online forum exists for using the XO laptop as an assistive technology for disabled persons. The Portugal Telecom Foundation has also carried out numerous projects to modify computers for use by disabled persons, including children. In Russia, a project was initiated to provide LCCDs for blind students.

Governments have encountered some obstacles in modifying LCCDs for use by disabled persons. In Russia and Uruguay, the governments were unable to install the accessibility application on the low-cost computers because of hardware limitations, so they instead had to use regular computers. Uruguay also plans to provide adapted computers for deaf and physically challenged children; however, the cost of the adaptive software is expected to be more than the price of the computers (USD 150).

At this stage, it is too early to determine the costs of making adaptations in each country. However, various groups are working on projects that will provide a track record, through shared experiences, to identify ways to reduce costs. In addition, charitable organizations, whose donations are often targeted for the disabled, could provide a funding resource to defray the costs of making computing devices accessible to disabled children.
3.1.2 Servers

LCCD programs are significantly enhanced through the inclusion of computer servers. These computers are generally more powerful than the LCCDs and provide a range of services, including Internet connectivity, printer sharing, file downloading and disk storage. Assuming such services are desirable, then the cost of the servers, peripheral devices such as printers, and networking costs must be factored into the LCCD project.

Since LCCDs do not have sufficient capability to function as servers, most countries use more powerful computers. The price of the servers varies by the amount of RAM, processor speed, disk capacity and computer brand. In some projects, one server is purchased per school. In addition, the purchase of printers and scanners needs to be contemplated, along with consumables such as paper and ink cartridges or laser toners.

Most LCCDs have Wi-Fi capability but require connectivity through an access point to the Internet. Although a server is not needed for Internet connectivity, it provides additional features such as better network security and management. In addition, performance can be enhanced by storing applications and content on the server for distribution to the LCCDs, instead of having each student access the Internet to download files.

Other costs associated with Internet access include the cost of routers and monthly subscription fees. Depending on the type of Internet access, additional adapters may be required. For example, if the connectivity is through a third-generation (3G) wireless network, then a wireless network adapter will
need to be purchased. Given the added complexity of computer servers and Internet access, some countries have outsourced the support and maintenance of their equipment.

3.1.3 Electricity

The availability of electrical power has a major impact on the scope of an LCCD program. Some form of electrical current is needed to recharge the LCCD devices and to power servers for supporting the program. Power costs can be divided into three areas:

1. Existing electricity at schools slated for LCCDs;
2. The charging aspects of the LCCD itself; and
3. On-going electrical costs.

If electricity does not exist at the school, the cost of providing some type of power to recharge LCCDs needs to be factored into the project costs. The type of power option will depend on whether the school is close to the electrical grid. If so, then the cost of connecting the school to the electrical grid must be contemplated. If not, then off-grid options need to be explored.

One solution would be to use a generator, typically powered by diesel fuel. This can be a costly proposition, because it requires the purchase of a generator, payment for the diesel and an on-going supply of fuel.

Another option is solar or wind power. Both involve hardware costs, but there are no recurring electricity or fuel costs. In Uganda, for example, a project run by an NGO has been using solar power to recharge LCCD batteries.

The type of LCCD selected has an impact on power needs, since some have self-charging options. There may not be an immediate need for electricity, but the scope of any program will be limited without having a reliable energy source. Networking options inevitably would be constrained, because there would be no power to run a server.

If a school does not have electricity, some households may have power at home, so the LCCDs can often be taken home and recharged. The battery power of the device itself varies among brands, as does the charging options. The figure below illustrates a variety of different options for charging the
battery. One consideration is a charger and plug. Although all the LCCDs supply dual voltage chargers, plugs can be problematic, because they vary widely from country to country. This was an issue in the Solomon Islands, where the plugs that came with the laptops did not match the outlets used in that country.

Figure 3-2: Power options for LCCDs


3.2 Software

Software refers to the LCCD’s operating system and applications, as well as to the educational content delivered to the LCCD.
3.2.1 Applications

Applications refer to programs such as word processors, spreadsheets, databases and Internet browsers. Basic applications are not necessarily a significant cost item, depending on: (i) the type of LCCD; (ii) the operating system; and (iii) software applications desired.

All low-cost computing devices come with some application software, along with the operating system. One cost consideration is whether commercial software such as the Microsoft Office suite of applications is necessary. If so, this software will need to be purchased; however, software manufacturers often give significant discounts for educational use of their software in many countries.\(^{37}\)

Many software applications are available at no cost. For example, popular Internet browsers (e.g., Explorer, Firefox, Chrome, Opera, etc.) are free and run on different operating systems. Likewise, the Adobe Acrobat document reader is also a free download and runs on various operating systems. The OpenOffice suite can be downloaded for free and includes word processing, spreadsheet, presentation, graphic and database software.\(^{38}\) It is available in various languages, runs on a number of operating systems (e.g., Windows, Linux), and can read and write files from other common office software packages.

In some countries, LCCDs must be usable with open-source software, because of the high cost of commercial applications. There is also a philosophical argument that commercial applications are not really necessary for primary school children:

"Children—especially young children—need the opportunity to learn far more than Word Excel, and Powerpoint. Of course, picking up these skills, having grown up with a laptop, will be readily accomplished."\(^{39}\)

3.2.2 Content

The term content covers the educational materials developed for use on computers and other LCCDs. That will have to be developed that is specific to the educational system of each country. Development costs vary depending on:

- The complexity of the content that needs to be created;
- Whether content already exists that can be modified for the LCCD that is being distributed;
- Whether content from other sources can be utilized;
- Whether the languages used in the country are specific to that country, or whether developers can draw on content developed in countries where the same language is spoken; and
- How much of the content development is done “in-house” and how much is contracted to third parties.

One of the consequences of conducting technology trials, or starting pilot projects, is that content development will initially consume a larger portion of up-front costs. In Haiti, for example, the development of Creole language content accounts for 2.6 per cent of total pilot project costs. But this content can continue to be used if the pilot is scaled-up to a full program, so the total cost will be lower over time.

The availability of free content can help to alleviate these costs. The One Laptop Per Child (OLPC) effort works with "Wikieducator," a site for open sharing of curricular materials. In the Solomon Islands OLPC pilot, primary schools are using free biology lessons downloaded from the Wikieducator site. The pilot project was also able to draw on content developed for an earlier distance-learning project covering teacher training in local languages, as well as agricultural content on beekeeping, turtle conservation and chicken farming.
3.3 Training

Teachers and students require training on how to use LCCDs. Beyond that, teachers need to understand how to use LCCDs in the classroom environment and incorporate them into their teaching methods.

Training in basic maintenance and repair may also be necessary in order to keep LCCDs operational. Some LCCD projects have an extensive support system of volunteers that can help defray training costs. Techniques such as “training the trainers,” where initial teachers or students are formally trained and they pass on what they learned to others, can also help to lower costs.

Training costs can also be internalized and incorporated into existing training frameworks. ICT learning is also different in that there is a significant amount of free training material provided with LCCDs or available online. Once initial skills have been taught, further advancement often depends on self-initiative and making use of the large amount of free training materials.??

3.3.1 Teachers

Teacher training involves a number of steps, which are generally sequenced. The initial group to receive LCCDs requires training in integrating the LCCD into the classroom environment and in routine trouble-shooting and maintenance. Those teachers, in turn, generally pass their experience on to the next group to receive LCCDs.?

The LCCD project plan for Paraguay, for example, illustrates how the “train the trainers” scheme is used. Four consultants were hired to train 20 teacher trainers, who in turn will train the 146 teachers from the participating schools.??

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3.3.2 Students

Student training is typically not a cost item since it is part of the educational process. In other words, students learn how to use the LCCDs in the classroom, just as they would learn mathematics or science.

3.4 Sustainability

Sustainability costs revolve around elements for maintaining and monitoring the LCCD program. This includes equipment maintenance, repair, replacement and disposal, as well as monitoring and evaluating the impact of the project.

3.4.1 Maintenance

LCCDs and other supporting equipment, such as servers and networking components, require maintenance and repair. In addition, support staff—including new personnel to be hired or contracted—need to receive LCCD maintenance training.

One way of managing maintenance and support costs is to introduce a tiered system. This involves providing adequate training at the local level, where the LCCDs are installed, to handle routine software and hardware fixes. This ensures that basic repairs can be made without having to send the equipment somewhere else, depriving students of LCCDs for a long period. A more sophisticated level of maintenance and repair can then be provided at regional or national levels for more serious problems.

Maintenance costs depend on how the program is designed. Costs can be internalized if existing students and staff are trained in basic repair and maintenance and, in turn, pass their knowledge on to
others (“train the trainers”). Specialized staff will require training for more sophisticated repair activities.

In some cases, maintenance and repair support has been included as part of the bidding requirements for government tenders. Project administrators should obtain performance guarantees and equipment warranties from vendors whenever possible. They should also scope out the logistics for getting LCCDs repaired or replaced.

Any LCCD program should also maintain a stock of new components and replacement LCCDs. In the case of Haiti, for example, 5 per cent of project costs were set aside for replacement stock-piling.

### 3.4.2 Recycling

Policies must be established for the environmentally sound disposal of LCCDs and other equipment. The movement to distribute LCCDs in schools is a relatively recent phenomenon, so experience in this area is still evolving. Furthermore, most LCCDs have yet to reach the end of their lifespans. For example, the estimated lifetime of the XO is five years. One step governments could take is to raise this issue with vendors and see if they would be willing to recycle the equipment.


### 3.4.3 Monitoring

The purpose of most LCCD pilots is to test the suitability of a particular LCCD for the learning environment. So it is vital to establish a monitoring and evaluation process. This involves testing students prior to the introduction of the computers, and then later evaluating how the computers impacted the students’ learning. The evaluation also should include testing the suitability of the LCCD, as well as the utility of the supporting infrastructure and environment.
Costs for evaluation might include the monetary compensation for personnel to carry out the evaluation, as well as the development of "before" and "after" tests. Monitoring and evaluation costs vary by country, depending on the detail and complexity of the evaluation. In Haiti, 3.9 per cent of project costs are set aside for monitoring and evaluating the project. Part of the evaluation in Haiti is based on a standardized test administered by UNESCO throughout Latin America and the Caribbean.

3.5 Managing Costs Effectively

LCCD programs have significant costs, and successful management of those costs is critical to the process of generating funding. One decision is whether the national government should adopt a national plan to minimize cost elements through economies of scale or whether local school administrations should adopt their own plans.

The scope of the project informs this decision. If the LCCD initiative is still in a pilot phase, then procurement may not require centralized intervention. Indeed, most pilots are small-scale efforts, often largely financed through development assistance and donations from equipment vendors. Therefore, they do not require a significant initial outlay from the government. Furthermore, local administrations might be better placed to form partnerships and more able to get the project off the ground quickly.

A large-scale implementation through the government’s education ministry, however, can aggregate purchases to achieve lower costs. The national government is also more likely to have procurement expertise and the capability to evaluate rival offers. One method of selection is to use a tender process, in which the project’s requirements are laid out in detail. In Brazil, for example, a tender process was integrated into the country’s "e-procurement" system.

4 Implementing a Sustainable LCCD Programme

This section of the toolkit identifies elements necessary to achieve a sustainable low-cost computing device (LCCD) program.
4.1 Project Coordination

The implementation of an LCCD program is a complex undertaking. LCCDs can have significant impacts on classrooms, teachers, training methods, distribution of educational materials and curriculum. They also affect school funding and infrastructure requirements (e.g., electricity and networking). Given the complexity of such programs, many countries have chosen to implement LCCD projects with various partners.

The decision to implement an LCCD program is sometimes made at the highest level of government. If the government changes, then there may no longer be support for the program. This was the case in Ghana and Nigeria, where new governments stopped LCCD programs. One way to avoid this is to create a national coordinating committee, which adds legitimacy and sustainability to the project.

Once the decision is made to implement a low-cost computing device program, it is generally coordinated through the country’s educational ministry. Furthermore, partners often insist on some kind of commitment from the education ministry before they will participate.

Although the education ministry may take overall responsibility for the program, ongoing management is sometimes delegated to a technical branch of the ministry or another agency of the government. In Uruguay, the Technological Laboratory of Uruguay (Laboratorio Tecnológico del Uruguay or LATU), a quasi-autonomous organization, coordinates the country’s LCCD program. LATU is managed by a board of directors overseen by a government representative (from the Ministry of Industry, Energy and Mining), a representative from the Chamber of Industry, and a delegate from the central bank.

In Haiti, the Ministry of Education and Vocational Training (MENFP) is responsible for overall LCCD coordination. It chairs the ICT in Education Steering Committee, which consists of both public and private sector representatives that oversee the project. The pilot is implemented by the Project Coordinating Unit (PCU), located within the MENFP.

In Nepal, the LCCD project is coordinated by the Department of Education, with input from the Ministry of Education and Sports, the Curriculum Development Center and the National Center for Educational Development. Participants also include non-governmental organizations (NGOs) and international partners such as Danish development assistance (see figure below). School administrators, teachers
and parents are also part of the implementation process. The Open Learning Exchange (OLE), a Nepalese NGO, has an agreement with the government of Nepal to help implement the project.

Table 7-1 provides a list of project responsibilities among different partners.

**Figure 4-1: LCCD Project Coordination and Partners in Nepal**

Note: DoE = Department of Education, MoES = Ministry of Education and Sports, NCED = National Centre for Educational Development, CDC = Curriculum Development Center, OLE = Open Learning Exchange.

Source: Open Learning Exchange Nepal.

### 4.2 Funding

A full-scale, one-to-one LCCD program typically exceeds the resources of most developing nations. Consider Nepal, where the government has drastically raised the education budget, planning to
spend?USD 688 million for the 2009/2010 school year. Assuming a price of USD 150 for each LCCD, and with 4.4 million primary students, the cost of providing each Nepalese pupil with an LCCD would be USD 663 million -- practically the entire education budget.

In addition, if countries opt for the one-to-one model, they need to realize that this is a long-term commitment, since each year there will be a new class of children that will require their own new laptops.

Most LCCD programs are conceived as public-private partnerships so that costs can be spread among various parties. In addition, some vendors sponsor initial donations of computers for pilot projects. Somewhat surprisingly, development assistance has yet to be significant in this area, despite the educational potential and economic importance of access to ICTs.


4.2.1 Government

Governments usually must cover some funding to demonstrate commitment and sustainability:

The OLPC Association focuses on designing, manufacturing, and distributing laptops to children in lesser developed countries, initially concentrating on those governments that have made commitments for the funding and program support required to ensure that all of their children own and can effectively use a laptop.44

The extent of the government’s financial support will depend on the scope of the program. A pilot project in a few schools will not entail significant government resources, whereas a full-scale national implementation would call for a government funding commitment.
In Haiti, the government is only financing USD 100,000, or 2 per cent, of a pilot LCCD program, with the balance coming from the Inter-American Development Bank and the OLPC Foundation. A key government decision will be how much it can internalize costs by absorbing the resources required for a LCCD program into existing processes. This will require prioritization of educational goals to show commitment to LCCDs and one-to-one computing.

Some governments have made a serious commitment to LCCD for schools by providing significant funding. A few middle-income countries are largely funding LCCDs from their own education budgets. In the case of Uruguay, for example, the government allocated 497 million Uruguayan pesos (USD 21 million) to its LCCD program in 2007, almost 3 per cent of its education budget. The Uruguayan government has attracted other partners to the program to help defray costs. This includes the incumbent telecommunication operator, which is providing Internet access. Meanwhile, a group of volunteer students has been set up to provide computer training.

In Brazil, the federal government funds equipment, Internet access, training and assessment, while state and municipal governments are expected to provide the necessary school infrastructure (e.g., electricity) and logistical support, and to forge partnerships with other stakeholders and potential funding sources.

4.2.2 Private sector involvement

The private sector has been active, in some countries, in supporting low-cost computing device initiatives. Vendors such as OLPC and Intel have donated LCCDs for numerous projects around the world. OLPC also has a facility on its web site allowing individuals to contribute money for donated computers. A growing number of telecommunication firms are becoming active in low-cost computing programs. They can use their network management experience, particularly in countries where Internet access
has been part of the deployment. Although the provision of networking services has been a typical support activity, some operators have also donated computers. Examples include:

- In **Afghanistan**, mobile operator Roshan provided networking support for the country’s low-cost computing device project as well as project management skills.
- **MTC**, a mobile operator in **Namibia**, contributes 1 per cent of its revenues each year to social projects. It has invested over USD 1 million in the purchase and distribution of laptops with broadband connectivity. Because many schools in Namibia are not connected to the national power grid, MTC is also giving generators to more than 300 schools, in order to power the computers. 140
- In **Uruguay**, incumbent telecommunications provider ANTEL has supported the country’s student laptop program by providing Internet connectivity to school, with a discount on the service fees. 141
- In **Mexico**, Carlos Slim has donated 100,000 computers to public schools through the Casa Telmex Foundation. 142 Based on the Intel Classmate, the computers are being distributed to some 1,400 junior high schools throughout the country. Mr. Slim is the majority owner of America Movil, Latin America’s largest mobile group, as well as the incumbent Mexican operator, Telmex.


142 [http://www.carlosslim.com/responsabilidad_fundacion.html](http://www.carlosslim.com/responsabilidad_fundacion.html)

### 4.2.3 Non-Governmental Organizations (NGOs)

Non-Governmental Organizations (NGOs) are also supporting various LCCD programs. The Internet Society, for example, has provided funding to evaluate the LCCD project in the Solomon Islands. 49 In one of the world’s largest non-governmental LCCD programs, the Volnoe Delo Educational Foundation...
is providing funding for implementing LCCDs in Russian schools. In Uganda, the Maendeleo Foundation operates a Mobile Solar Computer Classroom. A jeep takes Classmate PCs to schools in different villages; the LCCDs are recharged using solar panels mounted on the roof of the jeep.

4.2.4 Development Assistance

Some multi-lateral and bi-lateral development agencies are playing a significant role in the LCCD movement. For example, the Inter-American Development Bank (IDB) is providing funding support for LCCD pilots in Haiti and Paraguay. In Uruguay, it has provided assistance for technical support and evaluation of the LCCD program and its extension to secondary schools. The IDB is also funding evaluation of LCCD pilots in Brazil.

In terms of bi-lateral assistance, the United States Agency for International Development provides assistance for Afghanistan’s LCCD project. The Danish government is assisting with funding an LCCD pilot project in Nepal.

http://www.picisoc.org/tiki-read_article.php?articleId=45
http://www.intelchallenge.com/mobilesolar

http://www.iadb.org/Projects/project.cfm?id=PR-T1081?=en
http://www.iadb.org/projects/Project.cfm?lang=es&id=ur-m1029?oject=ur-m1029&query=
4.2.5 Volunteers

Although volunteers do not usually provide direct funding, they can indirectly help defray training and logistical costs by providing free and often skilled labor. Volunteers have been used in various LCCD projects, particularly to assist with training activities.

In Uruguay, volunteers are organized under the Support Network of the Plan Ceibal (Red De Apoyo al Plan Ceibal or RAP CEIBAL). University students, professionals and retirees from all over the country participate in local groups that offer assistance in areas such as equipment delivery, training children in using the LCCDs, developing learning exercises for students and parents and researching technical issues.

OLPC has an OLPCorps Africa project, in which 30 college students have been trained to provide technical support for OLPC pilots throughout Africa. After a 10-day orientation course in Rwanda, volunteers were sent in teams of two to different African countries for up to 10 weeks. They were provided with 100 XO laptops for deployment and USD 10,000 to cover costs. The OLPC also organized an internship program for college students to work with local personnel in Peru and Uruguay, where they help to implement LCCD programs.

58 http://www.ambkathmandu.um.dk/en/menu/TheEmbassy/News/DanishsupporttoMinorProject.htm and
59 http://rapceibal.blogspot.com/
4.2.6 Parents

In some countries, parents are required to contribute towards defraying the cost of purchasing the low-cost computers. This can lead to reduced theft and damage, if parents and students assume ownership and responsibility for the equipment they have purchased.

In Rwanda, parents of students in private schools must purchase LCCDs. Arrangements are being made for long-term loans from banks to be repaid by parents of students. Similarly, in Nigeria, parents of students from the private Corona Secondary School have purchased Classmate PCs for their children. In Portugal, the Magellan program charges parents for LCCDs based on their economic situations. Low-income households do not have to pay, while medium-income families pay EUR 20 and those with higher incomes pay EUR 50.

http://allafrica.com/stories/200901080184.html
http://www.magalhaes.gov.pt/portal/server.pt/community/e-escolinha/faq#Quanto_custa_o_computador [A Portuguese mobile operator ran a contest in early 2009 to award one Magalhães PC per day for users who had topped-up their prepaid cards. See http://www.telecom.pt/InternetResource/PTSite/UK/Canais/Media/DestaquesHP/uzomagalhaes.htm]

4.2.7 Universal Service Funds

Universal service funds can be a source of financing in some countries. These funds, generally administered by the nation's telecommunication regulator, are composed of contributions from operator revenues. They are normally designed to defray the costs of providing telecommunication services in remote or rural areas, or to subsidize services for low-income users. Universal service funds have been used in several countries to finance the acquisition of computers for schools:
• In Colombia, the Computers for Education project draws on the country’s universal service fund to distribute recycled computers to schools. More than 14,000 schools have benefited from the project, which has distributed more than 200,000 computers.

• In Morocco, the universal service fund is used to finance the country’s GENIE program, which installs computer labs in schools. In 2006, the program financed the distribution of more than 27,000 computers in more than 1,800 schools, impacting some 1.4 million students.

• In Nigeria, a tender was issued in 2009, inviting bids to install 100 PCs in each of 550 secondary schools across the country. The project will be financed by the Universal Service Provision Fund.

4.2.8 Student Installment Plans

One method to help students buy low-cost computers is to let them pay over time, on an installment plan. This makes the computers more affordable and allows the students to begin using them immediately.

Installment programs are generally aimed at secondary and, more often, tertiary-level students. One of the first countries to implement this type of program was France. The Ministry of National Education launched the MIPE (Micro-Portable Etudiant) program in 2004. The effort was undertaken in conjunction with almost all of the country’s universities, as well as with private partnerships involving computer vendors and banks. MIPE offers university students an opportunity to purchase a laptop with Wi-Fi capability and pay for it in installments. The payments are spread out over three years -- roughly the equivalent of paying EUR 1 per day. For their part, the universities have agreed to provide free Wi-Fi access.

64 http://www.computadoresparaeducar.gov.co
More recently, the Portuguese government has worked with mobile operators to give secondary school students laptops, bundled with mobile broadband subscriptions (see the Portugal Case Study). In Namibia, mobile operator MTC offers university students a laptop for NAD 3,999, with a discount on monthly mobile broadband Internet access.  

4.2.9 Donations

Contributions of money or used computers can help defray expenses. Used computer donations are a key component of recycled computer programs, and they can play a part in projects to spread computers to schools in developing countries. Computer Aid International accepts donations from both businesses and individuals.

One example of a national program is Colombian Computers for Education, which accepts used computers from companies, the public sector and individuals. OLPC accepts cash donations, which are then used to purchase a laptop for a child in a developing country.

67 http://delegation.internet.gouv.fr/mipe/projet.htm

68 http://www.atelier.fr/statistiques/10/30112004/operation--pc-1-euro-jour--40000-unites-vendues-28720-.html

69 http://connected.mtc.com.na/

70 http://www.computeraid.org/businessdonors.htm


4.3 Distribution

Under the one-to-one LCCD philosophy, each child has his or her own computer. In practice, however, this may be difficult for most developing nations to achieve, given the enormous expense of outfitting each child with a computer -- particularly in countries with large populations of children.

Although one-to-one computing may be a long-term strategy, in the short term, governments may have to make choices about which schools and which students should benefit immediately from LCCDs, and which populations will have to wait. One of the first distribution choices is deciding which grades should benefit from the program. Many programs and most LCCD features are aimed at primary schools, but there have also been implementations in secondary and even tertiary-level institutions.

One approach may be to establish initial pilot projects in different school environments. In a monitored environment, authorities can then test how LCCDs will be used in those different school situations. They can compare LCCD pilots in urban and rural settings, with public and private schools, and with younger and older students.

This was the approach taken in Haiti, where a representative sample of different school environments was selected. Determining a representative sample size will determine the number of LCCDs that will be needed for a pilot to ensure a scientifically accurate evaluation across a range of school environments.

Saturation

Another distribution strategy is saturation. This involves selecting a small number of schools, but then providing LCCDs to all students, in all grades, in those schools. The benefit of this approach is that the pilot can be tested across a range of grades in one environment. Also, this often requires fewer LCCDs and minimizes resentment among children that might arise if some students have LCCDs and others do not.
One way of achieving saturation with a wider school distribution is through sharing the LCCDs, particularly where schools are operated in shifts. For example, this was done in a few areas of Brazil. One drawback is that students cannot take the LCCDs home to share with parents. This can be an issue where the intent is to implicitly raise household computer and Internet connectivity by having parents and siblings use the devices. It may also be a problem if school administrators are counting on students to recharge the LCCDs' batteries at home.

Another factor influencing the distribution for testing would be school and community acceptance. In Afghanistan this was one of the reasons cited for the selection of the first pilot school:

"The parent's attitude, community acceptance, teacher's and school's representative overall attitude towards OLPC were the major factors for selection. Also the school size and the number of students in that school was the best match for our first pilot school." 

Electricity

The goal of many LCCD programs is to provide computers in rural areas. The main factor impacting this is the availability of electricity. For example, Brazil's ProInfo project established specific pre-qualification criteria for schools interested in obtaining computers. One of those prerequisites was the existence of electricity (see table below). Governments can install electricity in rural areas that are targeted for LCCD programs. However, the costs can be high, particularly if the area is a long distance from the electricity grid. Other options include providing stand-alone solutions, such as diesel-powered generators or solar energy. Another consideration for areas with a lack of electricity is the type of LCCD selected. Some offer a number of off-grid and human-powered solutions for re-charging the battery.

Table 4-1: School Selection Criteria for Brazilian ProInfo Project

<table>
<thead>
<tr>
<th></th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of School</td>
<td>Elementary</td>
<td>Elementary</td>
</tr>
<tr>
<td>Number of Students</td>
<td>&gt;50</td>
<td>?</td>
</tr>
<tr>
<td>Electricity</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Distribution Timetable

If the decision is taken to scale-up the program to incorporate the whole country, a timetable will be needed, since not all of the devices can be distributed simultaneously. In Uruguay, LCCDs were distributed:

- First, to a school in a pilot school in one province,
- Second, to all the schools in the same province, then
- Third, to all schools nationwide except for the capital, and finally
- Fourth, to the capital (see figure below).

The process will take approximately three years, but it will ensure that the less-privileged schools outside the capital receive LCCDs first. In Brazil, the current phase of the LCCD program calls for distributing 150,000 LCCDs to 10 schools in each of its 27 provinces, as well as in five municipalities.

**Figure 4-2: Sequencing LCCD Distribution in Uruguay**


Note: Departments are the top level administrative unit in Uruguay equivalent to a province or state. There are 19 departments in Uruguay.

Source: Plan Ceibal.

Another concern might be to prevent LCCD distribution only to the most privileged elements of the population. Most of the trials and deployments to date, however, have adopted a conscious policy of distributing computers to public (rather than private) schools, generally outside urban areas. In order to avoid allegations of favoritism or corruption, the rationale and plan for LCCD distribution should be documented and made publicly available.
4.3.1 Gender Issues

Explicit discrimination regarding gender has not been a significant issue in the on-going LCCD trials and implementations around the world.

The concept of one-to-one computing is inherently more equitable than a shared environment, in which some students could come to dominate access to the limited number of computers. Problems with equitable distribution are more likely to arise as a result of the existing socio-cultural environment in a country. For example if schools are not integrated by gender, then there is more scope for a lack of transparency in LCCD distribution. In Afghanistan, where many primary schools are separated by gender, LCCDs were distributed to a girl’s school and a “mixed” school in Kabul. In the mixed school, girls study in the morning and boys in the afternoon.

LCCDs also hold the potential to become devices for empowering and training mothers, if students are allowed to bring them home. OLPC has found that bringing home an LCCD has a great influence on the entire family. Children often teach computer skills to their mothers and even grandmothers. For this reason, OLPC often insists that governments let children take the LCCDs home.
5 National Case Studies

The following national case studies illustrate various aspects of the cost, coordination, logistical and management issues associated with implementing and sustaining a program to provide or support low-cost computing devices in schools:

- Afghanistan case study
- Brazil case study
- Nigeria case study
- Peru case study
- Portugal case study
- Rwanda case study
- Uruguay case study
6 Conclusion

Greater government focus on ICTs for education, and ongoing reductions in the price of laptops for students, are generating a lot of interest in the potential for boosting computer availability for students in developing countries. This module has examined various issues that should be considered in implementing an LCCD distribution program for schools. It also has presented a variety of country experiences. Based on the analysis, several conclusions can be drawn:

- The selection of a particular LCCD depends on a country’s educational strategy and development status. Some LCCDs, such as the OLPC XO and Intel Classmate, are expressly designed for children in developing countries, featuring special ergonomic and technical features. Other laptops may not have these features and may not be as appropriate for young children. Some laptops may not be suitable in difficult environments, such as extreme temperatures or lack of electricity.

- The selection of a particular LCCD is also dependent on the pedagogical orientation of a country, as well as on government software policies and the age of the schoolchildren. The OLPC XO, for example, is specifically aimed at primary school children and may not be suitable for older students. At the same time, traditional, mass market laptops may not be as appropriate for primary school students. Some countries have policies to adopt or favor certain operating systems and software, which also impact LCCD selection.
• The immediate introduction of a one-to-one computing model is beyond the financial capability of most developing countries. Therefore, countries need to consider a phased approach involving a mixture of installing computer labs and distributing individual computers—the two methods are complementary rather than inconsistent. One-to-one computing will radically impact the school environment. Governments and educational institutions must consider the positive and negative aspects. For example, one-to-one computing democratizes ICTs by making an LCCD widely available to all children regardless of income level, urban or rural location or gender. They can also be taken home, so that every household with a child also becomes a household with a computer. This may well be disruptive to the established learning environment.

• Objective studies about the costs and benefits of education-oriented laptops, commercially available laptops, recycled computers and thin clients are still lacking. The evidence to date is not entirely convincing, because it is typically sponsored by organizations that have an interest in a particular solution. Countries also need to be aware that, although there is an altruistic element to many LCCD programs, private companies are profit-oriented. Governments must carefully evaluate LCCDs and plan programs that are driven by the educational sector’s needs and resources, rather than driven by offers of donated computers for pilot projects.

• There must be a long-term commitment to one-to-one computing and LCCDs. Each year, new students will enroll and need additional LCCDs. Governments need to ensure ongoing funding and sustainability to support this.

• Another financial challenge for developing countries is the need to balance the introduction of broadband Internet connectivity in schools with promoting one-to-one computing. The goals of one-to-one computing and broadband connectivity are both important, but with limited budgets, governments need to balance priorities. Therefore, it may be difficult to implement both one-to-one computing and broadband connectivity simultaneously. One-to-one deployment plans may need to be adjusted in order for schools to also attain Internet connectivity.
7 Checklist

Several useful steps, or decision-points, in implementing an LCCD distribution program can be summarized in the following "checklist."

Coordination
LCCD projects are usually a collaboration between the ministry of education and other partners such as NGOs, international donors and the private sector. Who will participate in the project? Who will take overall implementation responsibility, including integration of pedagogical questions, dealing with LCCD vendors, handling technological issues, coordinating transport and delivery and liaising with schools and volunteer groups? This step involves answering these threshold questions.

School Designations
Which schools will participate? How many students and teachers will be involved? Do the schools have electricity? What languages are spoken? What is the transportation situation? Are parents supportive?

Finance
Where will funding come from? How much are import duties and taxes? Should a tendering process be used? How much of the project should be outsourced?

LCCD Selection
What are the requirements for the LCCD (e.g., operating system, applications, battery life, national language interface, keyboard, etc.)? How much does it cost? What kinds of discounts are available? What kind of support network (e.g., content, training manuals, etc.) is available? What kind of warranties can be obtained? What kind of battery re-charging and plug configuration are available? Should LCCD selection be tendered?

Networking
Is networking capability needed for the project? Do schools have access to the Internet? What kinds of connectivity options are available (e.g., dial-up, DSL, WiMax, 3G mobile, VSAT)? Is mesh networking needed? What are the costs of networking (e.g., installation of network adapters and routers, recurring service costs)? Can local telecom operators or ISPs assist with networking? Are firewalls needed for content control?
Transportation and Distribution
How far is the country from the LCCD manufacturing location? What is the lead time for manufacturing the LCCDs? How will the LCCDs be transported (e.g., by air, by ship, etc.)? What are customs formalities and how long is the delay? How will the LCCDs be distributed within the country? What is the deployment schedule?

Content
What education content is needed to support teaching? What content comes with the LCCD? What content is available through the LCCD support network? Is it free? How easy is it to convert existing national content for use on the LCCD? Will new, nationally developed content be needed? Is content documentation available? How will free content be downloaded from the Internet and distributed?

Servers and Peripherals
Will servers be used? What kind of computers will be used for the servers? How much additional disk space is needed? What kind of peripherals (and how many) will be needed (e.g., printers, scanners)? Should servers be included in a tender? Should server support be outsourced?

Electricity
How will LCCDs be recharged (e.g., on-grid or off-grid electricity)? Will universal power supply (UPS) backup be needed? What is the recurring electricity cost? Training
How will teacher training be implemented? What will be taught? What are the logistics (e.g., centralized training or training on-site)? What kind of documentation will be needed? Should training be outsourced and/or included in a tender? Do the LCCDs themselves have training modules?

Support and Maintenance
How will the project be technically supported? Should support be outsourced and/or included in a tender? What is the maintenance procedure? How will students and teachers be trained in routine maintenance and troubleshooting? What stock of inventory should be maintained for spare
components or replacement? What is the procedure for sending LCCDs for repair? How will equipment be recycled?

**Monitoring**

How will the project be monitored and evaluated? Who will carry out the monitoring and evaluation?

**Table 7-1: Project Responsibility Checklist**

<table>
<thead>
<tr>
<th>Government</th>
<th>Vendor</th>
<th>International agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>??? Coordinate all the parties concerned within the country;</td>
<td>?????? Donate computers, including any necessary adaptations for use in the beneficiary country (e.g., language keyboards, PIN configurations, etc.) and reasonable warranties;</td>
<td>??? Coordinate with other partners to identify applications and content-related requirements to be included in the computers;</td>
</tr>
<tr>
<td>??? Nominate a national project coordinator responsible for coordination with the education ministry and all other partners;</td>
<td>??? Exempt duties and/or taxes for the computers;</td>
<td>??? Support local training by underwriting expenses, making arrangements for training at local/regional training institutes, etc.</td>
</tr>
<tr>
<td>??? Identify schools to receive the computers;</td>
<td>??? Identify schools to receive the computers;</td>
<td>??? Support local training by underwriting expenses, making arrangements for training at local/regional training institutes, etc.</td>
</tr>
<tr>
<td>??? Arrange for local transportation of the computers from the port of entry to the designated schools;</td>
<td>??? Arrange for local transportation of the computers from the port of entry to the designated schools;</td>
<td>??? Negotiate, through the project coordinator, signed agreements with the beneficiary country to ensure its commitment to the project;</td>
</tr>
<tr>
<td>??? Provide supporting infrastructure (including electricity), Internet connectivity, as well as printers, scanners, additional memory devices and servers as required at local sites;</td>
<td>??? Provide supporting infrastructure (including electricity), Internet connectivity, as well as printers, scanners, additional memory devices and servers as required at local sites;</td>
<td>??? Negotiate, through the project coordinator, signed agreements with the beneficiary country to ensure its commitment to the project;</td>
</tr>
<tr>
<td>??? Create awareness and organize community learning</td>
<td>??? Create awareness and organize community learning</td>
<td>??? Conduct an evaluation of the pilot phase of the project and identify areas for improvement;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>??? Following the evaluation of the pilot phase, assist the beneficiary country to design a comprehensive national LCCDs in schools program and assist the beneficiary country in</td>
</tr>
</tbody>
</table>
and information exchange campaigns, including meeting at all schools with teachers, students and parents to build their support for the project; Keep other partners informed; Translate donated training materials into local languages as required; Identify a team of IT specialists to participate in the technical maintenance and support training to be provided by the vendor, so that local IT specialists will be able to maintain and support the laptops. Assume responsibility for software upgrades as required.

Table 7-2: Feature Comparison of Low-Cost Computing Devices for Students

<table>
<thead>
<tr>
<th></th>
<th>XO (OLPC)</th>
<th>Classmate (Intel)</th>
<th>Eee (ASUS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price</strong></td>
<td>USD 199&lt;sup&gt;104&lt;/sup&gt;</td>
<td>USD 280&lt;sup&gt;105&lt;/sup&gt;</td>
<td>USD 300&lt;sup&gt;106&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>242x228x32mm</td>
<td>7.5 x 9 x 1.5 &quot;</td>
<td>8.9x6.7x1.33 &quot;</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>1.45 Kg with LiFeP battery; 1.58 Kg with NiMH battery;</td>
<td>1.27 x 1.49 Kg</td>
<td>2.2 pounds</td>
</tr>
<tr>
<td><strong>Battery life</strong></td>
<td>22.8 Watt-hours (LiFePO4); 16.5 Watt-hours (NiMH); About 4.3-6 hours depending</td>
<td>6 hours (6-cell) 4 hours (4-cell)</td>
<td>Up to 3.5 hours</td>
</tr>
<tr>
<td></td>
<td>XO (OLPC)</td>
<td>Classmate (Intel)</td>
<td>Eee (ASUS)</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------</td>
<td>-----------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>on battery and assuming 3.81 Watts(^{107})</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPU</td>
<td>AMD 433 MHz</td>
<td>Intel 1.6 GHz</td>
<td>Intel 900 MHz</td>
</tr>
<tr>
<td>USB ports</td>
<td>3 (2.0)</td>
<td>2 (2.0)</td>
<td>3 (2.0)</td>
</tr>
<tr>
<td>Form factor</td>
<td>Convertible laptop with pivoting, reversible display</td>
<td>Clamshell or Clamshell/Tablet</td>
<td>Clamshell</td>
</tr>
<tr>
<td>Random Access Memory</td>
<td>256 MB</td>
<td>1 GB/512MB</td>
<td>1 GB</td>
</tr>
<tr>
<td>Storage</td>
<td>1 GB</td>
<td>8/4/2 GB Flash</td>
<td>16 GB</td>
</tr>
<tr>
<td>Operating system</td>
<td>Sugar (Linux-based)/ (Windows XP also available)</td>
<td>Windows XP / Linux</td>
<td>Windows XP Home</td>
</tr>
<tr>
<td>Networking</td>
<td>802.11b/g; 802.11s (Mesh) networking;</td>
<td>10/100M Ethernet; 802.11 b/g; WLAN Mesh with Linux</td>
<td>10/100M Ethernet; 802.11 b/g)</td>
</tr>
<tr>
<td>Display</td>
<td>Liquid-crystal display (LCD): 7.5&quot; 1200 x 900</td>
<td>8.9&quot; 1024 x 600 color LCD</td>
<td>LCD 8.9&quot; 1024x600</td>
</tr>
<tr>
<td>Camera</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>External audio / video ports</td>
<td>Headphone and microphone</td>
<td>VGA, headphone and microphone</td>
<td>VGA, headphone and microphone</td>
</tr>
<tr>
<td>Warranty</td>
<td>30 days</td>
<td>1 year</td>
<td>1 year</td>
</tr>
</tbody>
</table>


Credits

The Module on Low Cost Computing Devices for Schools 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.
Module-3-Providing-ICTs-to-Indigenous-Peoples

Introduction

The objective of this module is to provide the main factors that should be considered in implementing a community connectivity program to interconnect schools in Indigenous communities. The approach that this module incorporates is oriented towards creating an enabling environment for ICT development in Indigenous communities.

The module is divided into five chapters. Chapter 1 is an introductory chapter that explains the reason why a module on Indigenous communities is needed, and explains in detail the general structure of it. Chapter 2 shows Indigenous peoples' situations, their needs and aspirations regarding information and communications technologies (ICTs), and how those needs and aspirations have been incorporated into various international agreements and recommendations. Chapter 3 presents the main aspects of a public policy designed to create an enabling environment for the development of ICTs in Indigenous communities. Chapter 4 offers basic organizational guidance that any indigenous community should take into account when designing and implementing a community ICT plan. Finally, Chapter 5 invites readers to reflect on the content of the module, and to contribute with experiences and thoughts on the subject.

1 ICT Development for Indigenous Peoples

The objective of this module is to provide the main factors that should be considered in implementing a community connectivity program to interconnect schools in Indigenous communities. The approach that this module incorporates is oriented towards creating an enabling environment for ICT development in Indigenous communities.

The module is divided into five chapters. Chapter 1 is an introductory chapter that explains the reason why a module on Indigenous communities is needed, and explains in detail the general structure of it. Chapter 2 shows Indigenous peoples' situations, their needs and aspirations regarding information and communications technologies (ICTs), and how those needs and aspirations have been incorporated
into various international agreements and recommendations. Chapter 3 presents the main aspects of a public policy designed to create an enabling environment for the development of ICTs in Indigenous communities. Chapter 4 offers basic organizational guidance that any indigenous community should take into account when designing and implementing a community ICT plan. Finally, Chapter 5 invites readers to reflect on the content of the module, and to contribute with experiences and thoughts on the subject.

1.1 Why have a module on Indigenous peoples?

ICTs are a proven and effective tool to promote social and human development in many Indigenous communities in remote regions. ICTs are a means of communication with members of the community that have left in search of a better life in the cities or even in other countries. For some Indigenous people, these technologies are a means to promote their culture in other places, to access information about events in other parts of the world or in their own country, to start educational processes, and to promote the protection of their rights. Many examples of these processes will be included in this module.

In spite of the ICT benefits that digital community centers in schools offer to Indigenous communities, in many cases these centers have been abandoned or underused by the community. The simple installation of community centers does not ensure their success. So it is useful to ask what conditions have to be promoted so that these centers become an essential step for the development of the community, instead of passing into disuse.

The success or failure of these centers in fulfilling their objectives for poverty alleviation and the improvement of life conditions of indigenous peoples is not mere coincidence. Choices made during installation can determine the success or failure of an ICT center. These choices include what technologies to embrace, how to organize community involvement, and others. In essence, if the cultural, economic, political and social characteristics of the Indigenous peoples are taken into account, as indicated by the Declaration of Principles of the World Summit on the Information Society (WSIS), it can constitute an important step in ensuring the use of ICTs for development.

Experience has shown what steps should be taken during program development, policy design, implementation and management of school digital community centers, so that indigenous peoples can
attain the benefits of ICTs, while preserving their cultural heritage. In an effort to achieve the objectives of the Special Initiative for Indigenous Peoples and Communities, issued by the World Telecommunication Development Conference of 2006, this toolkit aims to share with government bodies, sector members and Indigenous communities the knowledge obtained from this experience.

1.2 How is this module organized?

The objective of this module is to provide the basis for implementing a community connectivity program through the interconnection of schools in Indigenous communities. In order to achieve this goal, it is necessary first to answer a series of questions that will help establish the panorama in which we will work.

1.2.1 Contents of Chapter 2. Who are the Indigenous peoples?

We will create a short sketch of Indigenous peoples - who they are, where they are and their main social and cultural characteristics - in order to understand why they need special attention.

Very frequently, poverty is considered the common characteristic among Indigenous peoples. Therefore, it appears to make sense that policies needed to help Indigenous people are the same policies being applied to help all poor people. Nevertheless, Indigenous peoples often are anything but poor; many of them are located in areas with vast amounts of natural resources. Moreover, they have ancestral cultural wealth that carries great knowledge about the biodiversity of the zones that they inhabit. This knowledge has allowed Indigenous peoples to conserve their ancestral homes and thrive in them. Furthermore, Indigenous peoples possess solid community structures and rich cultural expressions, among many other social goods.

The above notwithstanding, Indigenous peoples do have the lowest rates of human development. This dichotomy is not simple, and in order to approach such underprivileged communities we must be aware of the causes of their marginalization, so that we can correct the barriers that have prevented their development and avoid those barriers in the design of development projects.
The first part of this toolkit aims to do precisely that, in order to understand Indigenous peoples’ particular situations and the realities in which community ICT access programmes have to operate.

1.2.2 Contents of Chapter 3. What is the role of governments in the generation of an enabling environment for ICTs in Indigenous communities?

Helping Indigenous communities is not only a question of providing connectivity -- that is, it is not simply about giving materials or bringing services. Instead, it is about creating an environment that allows Indigenous peoples the full use of ICTs to promote their own development. The key is providing an enabling environment that encourages and facilitates the development of (1) ICTs in Indigenous communities and (2) applications and content from and for the people in those communities. School community access centers are the final link in a chain of necessary steps, all of which must be completed in order for the centers to function.

How can a school community access center operate when there are no trained personnel to maintain it or guarantee its use, or when the energy supply is inadequate, or when, by implementing such centers, vested local interests are strengthened, or when it is impossible to increase the service according to demand?

Studies of this issue have identified several factors that are essential in order to sustain communication in remote areas. These factors include skill building, community participation in policy design, the availability of radio frequencies and the incorporation of relevant content. Chapter 3 will provide examples of best practices and general guidelines for an evaluation of policies and programs developed on a national scale.

1.2.3 Contents of Chapter 4. What is the role of Indigenous communities in the use of ICTs for their own development?

The arrival of a new technology does not always generate benefits to the community. There have been cases of communities that used to be self-sustaining, but with the arrival of electric power ceased to be
so\(^1\), leaving them completely dependent on external support. New technologies always promote changes; whether these changes are beneficial or harmful for the community depends on its ability to seize the possibilities and utilize them in the most optimal way, according to their development aspirations.

The government’s role is to provide all of the necessary facilities in order to sustain ICT programs. It provides the enabling environment. But the success or failure of these programmes, depends entirely on the community. It is the community that determines how ICTs are used and for what purposes.

Chapter 4 draws attention to some of the key factors that communities must take into account during the installation of school digital centers. It explores what questions should be asked and answered before the implementation of these projects, and it highlights the organizational aspects that can be developed, along with ways to measure organizational performance.

Chapter 4 offers examples of practices followed by several communities in order to guarantee that ICTs provide benefits for them.

\(^1\) Inishbofin Island in Ireland is such a case.

### 1.2.4 Contents of Chapter 5. What have we learned and how do we see the future?

Finally, it is worth reflecting on all the topics covered, but above all, it is important to consider that this work has not yet concluded. Technological progress moves hastily, as those needs addressed by it do. We cannot predict the future; nevertheless, we can visualize some of the challenges that will have to be faced. This chapter leaves an open door for governments and communities to continue enriching this toolkit with their experiences in connecting schools in indigenous areas.

### 2 Who are the Indigenous peoples?

According to Convention 169 of the International Labor Organization (ILO) concerning Indigenous and tribal peoples in independent countries, Indigenous peoples are the heirs of original peoples. They “descend from populations that inhabited a geographical region at the time of the conquest or
colonization or during the establishment of current state borders and that, whatever their legal status, preserve all their social, economic, cultural and political institutions, or part of them.” This section of the toolkit explores the unique nature of Indigenous peoples and their ICT needs.

2.1 A look into the Indigenous world

Present on all continents, there are more than 320 million Indigenous people, accounting for 5 per cent of the world’s population. However, Indigenous peoples account for 75 per cent of the world's population living in conditions of great poverty. Conflicts over land and natural resources, discrimination and exclusion, human rights violations and the extinction of traditional cultures are evident from Greenland to the Americas, Africa and Indonesia, and they greatly affect the indigenous peoples.

The United Nations Report on Indigenous Peoples reveals an alarming situation. In the United States, an indigenous person is 600 times more likely to contract tuberculosis than the general population, and is 62 per cent more likely to commit suicide. In Australia, an indigenous child is likely to die 20 years before his or her non-native counterpart. While the difference in life expectancy in Nepal is also 20 years, in Guatemala, the difference in life expectancy is 13 years, and in New Zealand it is 11. At the same time, forced displacement and systematic extermination are some of the offenses committed daily against Indigenous peoples. In this context, digital exclusion has only accentuated mechanisms of isolation, oppression and exclusion of these populations.

Against this backdrop, technological progress represents many positive possibilities. The Internet, radio and television are some of the opportunities that Indigenous peoples now often enjoy. These new media have been employed as instruments to denounce violence and abuse, to support cohesion, and to strengthen and promote the appreciation of their cultures. Therefore, the involvement of original peoples in the Information Society is embedded in their use and adoption of ICTs. There are clear signs that the “digital divide” can turn into a “digital opportunity”.

2.1.1 Indigenous Peoples’ geographical distribution

According to The Indigenous World 2009 publication -- which is considered to be one of the major efforts in mapping the presence of Indigenous peoples -- there are 350 million Indigenous people in the world, distributed as described in the following sub-sections.
2.1.1.1 The Circumpolar North

More than 200,000 Indigenous people live in the frozen zone that includes Greenland, Sápmi-Sweden, Russia and Canada. The problems these people face include cultural discrimination, global warming and increasing exploitation of natural resources by large companies. In Greenland, 57,000 Indigenous people from the Inuit ethnic group occupy the coast of the Earth’s largest island, which has been semi-autonomous from Denmark since 1979.

It is estimated that between 50,000 and 100,000 Indigenous people live in the northern part of Scandinavia, distributed between Sweden, Norway, Finland and Russia. The Indigenous people embody linguistic minorities in all of these countries. Another 50,000 people belong to more than 100 Indigenous groups living in northern Russia, including Siberia and the Russian Far East.

In the Northwest Territories of Canada, the Indigenous population accounts for 22,000 people, or more than half of the local population. In addition, Canada’s 2006 census indicated that about 24,900 of the 29,325 residents of Nunavut were members of first nations populations (mostly Inuit). Nunavut was created in 1999 from part of the Northwest Territories as a majority-Indigenous territory.
2.1.1.2 North America

More than 3 million Indigenous peoples live in the USA and Canada. The Canadian government identifies more than 1 million people as “aboriginal peoples,” representing 3.6 per cent of the population, the majority of whom live in reservations. In the United States, there are 335 recognized tribes (not counting those in Alaska). Some 2 million people declare themselves exclusively Indigenous, and another 4 million consider themselves a combination of different ethnic groups. Among these populations, life expectancy is lower than the national average, and poverty rates are higher than among average citizens. One serious problem is the large number of young Indigenous people who commit suicide.

2.1.1.3 Mexico, Central America and South America

According to conservative estimates, 30 million Indigenous peoples live in this region. Due to the subjugation and exploitation produced during the conquest by Spain and Portugal, the peoples of this region have been characterized throughout their history by problems of social inequality, migration, conflict over land and water, and the dispossession and gradual loss of control over their lands. Human rights attacks, murders and political imprisonment are a reflection of the violence experienced by these peoples, from Mexico to Chile and Argentina. However, in areas such as Bolivia, Ecuador and Venezuela, there are signs of progress with respect to state recognition of Indigenous rights, as witnessed in the election of Bolivian President Evo Morales, the first South American chief executive considered to be an heir of the original peoples of the continent.

2.1.1.4 Australia and the Pacific

Indigenous peoples have lived in this region for more than 40,000 years, but currently there are only 1.5 million Indigenous people distributed throughout Australia, New Zealand, Guam, Papua New Guinea, Indonesia, Tuvalu and Kiribati. On one hand, ethnic diversity in the context of great biodiversity represents the richness of this insular region. In Papua (New Guinea] alone, there are more than 250 identified ethnic groups, and in Kiribati, 99 per cent of its inhabitants are indigenous Micronesians. On the other hand, this region is marked by social inequality.
Aboriginal Australian life expectancy is 17 years less than that of the non-Indigenous population in that country. In an unprecedented event, the Australian government recently apologized to the “Stolen Generation,” acknowledging the involvement of government power in crimes against the native population.

2.1.1.5 Asia

One of the great challenges in the region is the state recognition (or lack thereof) of Indigenous peoples, which makes the procurement of accurate population data more difficult. It is estimated that there are more than 200 million Indigenous people distributed from Japan to Indonesia and Bangladesh.

In China, Indigenous peoples account for 10 per cent of the population, which equates to nearly 125 million people, many of them in the poorest population segment in the country. The Japanese government has officially recognized the Ainu people on the island of Hokkaido, but only since the year 2000. Nine million Indigenous people inhabit the most isolated areas of the Philippines, where the lack of access to basic social services is more prominent, and where few opportunities for economic integration can be found.

In Malaysia, around 3 million Indigenous people are affected by the private exploitation of monoculture crops. Fifteen million people in Vietnam are known as the “Nine Mountain People.” Meanwhile, there are 461 groups in India that are classified as “protected tribes,” totaling more than 85 million people. However, there are constant accusations of attempts to exterminate these minority populations throughout the region.

2.1.1.6 Middle East

Palestinian Bedouins in Israel, who total 100,000, live in semi-nomadic tribes in the country’s mountainous deserts. They are often victims of the armed conflicts that plague the region. There are also significant Bedouin populations in Jordan, Egypt and other nearby Arab countries.
2.1.1.7 Africa

It is estimated that 40 million Indigenous people live on this continent. Populations living in the northern Sahara desert are nomadic or semi-nomadic, living by shepherding, hunting and gathering. In Mali alone, 13 million nomadic pastoralists can be found, while in Ethiopia there are 10 million Indigenous people. In Tanzania, there are 125 distinct ethnic groups, all of whom belong to some of the poorest populations on the planet.

The situation is no different in Central Africa. In Ruanda and nearby Congo, Indigenous peoples form a large collection of expatriate groups who were endangered by the civil war that ravaged the country -- more than 60 per cent only manage to eat once a day. In Burundi, deforestation generated in order to develop urban areas has reduced hunting and gathering opportunities, accelerating the loss of the Indigenous population. In the Republic of Chad, 99 per cent of Indigenous people are illiterate, and in Congo, the systematic violation of human rights affects the welfare of the majority of the population.

In southern Africa, the government of Botswana does not recognize Indigenous people, because it considers all citizens to be Indigenous. Throughout the region, there is great difficulty in finding exact numbers for Indigenous populations.

2.1.2 Indigenous peoples on the world stage

Economic, political and social marginalization is not the only situation shared by Indigenous peoples. These groups are also heirs to ancestral cultural wealth, guardians of their land and responsible for the preservation of life on it. They share communal ways of living in which each member of the community plays a role. Social organization features reciprocal relationships among all members, encompassing even the natural environment.

In general, we can say that Indigenous peoples share a number of values, which are manifested in different ways, but that coincide at a basic level and can be observed in expressions of their community life. Among those values are: specific democratic institutions; values of respect for, and a special relationship with, nature; land and resource organization and management; particular forms of family organization; and, of course, special priorities with respect to development.
All of the above highlights that Indigenous peoples have their own characteristics that distinguish them from the general population, and therefore have a series of specific rights. Guaranteeing these rights ensures the opportunity of pursuing development commensurate with their aspirations. Therefore, various treaties and recommendations have been established in the international arena in order to guarantee those rights -- most recently, the 2007 Declaration on the Rights of Indigenous Peoples.

**Recommended Reading**


### 2.2 The rights of Indigenous peoples and ICTs

The assertion of Indigenous rights is a topic of recent discussion. It reflects the historic struggle of these peoples to ensure the recognition of their communities, their cultures, and their ownership of land and natural resources. Many nascent agreements and international resolutions promote sustainable development and seek the participation of traditional peoples in the “Information Society.” Most of them include goals and objectives for implementing Indigenous rights associated with the right to communicate. Some of the most important are explored in the following subsections.

#### 2.2.1 Convention 169

*Convention 169 concerning Indigenous and Tribal Peoples in Independent Countries*, of the International Labor Organization (ILO) was signed in 1989, and was the first document that acknowledged Indigenous rights. It guarantees the members of these populations the equal enjoyment of rights and opportunities that the national legislation gives other members of the population, in order to protect their social and cultural identity, their customs and traditions, and their institutions. One quarter of the Convention is dedicated to education and Indigenous means of communication as key strategies for development. It can be found at:
2.2.2 Declaration on the Rights of Indigenous Peoples.

This Declaration is the main document on Indigenous rights. Signed by the General Assembly of the United Nations in 2007, it acknowledges that all peoples contribute to the diversity and richness of civilizations and cultures, which constitute the common heritage of humankind. With respect to the “Information Society,” the Declaration acknowledges the rights these peoples have to promote and protect their cultures, knowledge and traditions through the most varied forms of expression. In its Article 16, the Declaration determines that:

"Indigenous peoples have the right to establish their own media in their own languages and to have access to all forms of non-indigenous media without discrimination."

In order to achieve this, it directs that:

- States will take effective measures to ensure that public media adequately reflect Indigenous cultural diversity.
- States, with no detriment to their obligation to ensure freedom of expression, should encourage the private media to adequately reflect Indigenous cultural diversity.

2.2.3 The World Summit on the Information Society (WSIS).

The WSIS took place in two phases between 2003 and 2005, as a joint effort of the United Nations and ITU. Governments and world leaders made a strong commitment to bridge the digital divide with respect to ICT access at a global level, with specific regard to telecommunications and the Internet.

The WSIS identified a need to promote the development goals included in the United Nations Millennium Declaration and the Declaration on Human Rights, through ensuring universal access to ICTs and the sharing of knowledge and information with underprivileged peoples. Action plans and policy proposals have resulted in an attempt to reduce such inequalities.
With regard to Indigenous peoples, the WSIS set targets that sought to connect all villages to the Internet and to establish community access points. Additionally, it drew attention to the fact that these targets have to respect the cultural heritage of each community. WSIS documents can be found at:

http://www.itu.int/itsis/basic/about.html

2.2.4 The Economic and Social Council (ECOSOC) Resolution 46/2006.

This Resolution stressed the right of Indigenous peoples to new ICTs. It sought to ensure greater integration between traditional peoples and their cultures in the “Information Society,” reinforcing the goals and commitments established by the Summit. It can be found at:


2.2.5 United Nations Millennium Declaration.

The UN has set 2015 as the deadline for achieving most of its Millennium Development Goals (MDGs). These goals provide concrete and numerical benchmarks for tackling extreme poverty in its many dimensions. The first goal is to eradicate extreme poverty and hunger, the second is to achieve universal primary education and eradication of illiteracy, and the eighth goal is to develop a global partnership for development. The need for ICT connectivity in Indigenous populations is reaffirmed by these three goals. Nevertheless, as the deadline approaches, the world is immersed in an unprecedented economic crisis. A 2009 report, which keeps track of the progress toward meeting the MDG goals, can be found at the following webpage:

2.2.6 United Nations Permanent Forum on Indigenous Issues.

The Forum reiterates recommendations on the dissemination of information on Indigenous issues. It also promotes new ways to publicize the Forum to Indigenous communities and organizations through radio programmes, publications and other relevant cultural and educational means. The Forum provides expert advice and recommendations to various programs, funds and agencies of the United Nations System, raising awareness through the dissemination of relevant information and promoting the integration and coordination of activities related to indigenous issues. See the link below:


2.2.7 The 5th Ministerial Forum for Latin America, Caribbean and European Union on the Information Society.

Held in 2010, this forum agreed to strengthen existing strategies that attempt to diminish the digital divide and to recognize the specific needs of Indigenous populations in Latin America, the Caribbean and Europe. See the following link:

http://www.eclac.cl/cgi-bin/getprod.asp?xml=/socinfo/noticias/noticias/6/38716/P38716.xml;base=/socinfo/tpl/top-bottom.xsl

2.2.8 The Recommendation on the Promotion and the Use of Multilingualism and Universal Access in Cyberspace (2003) of UNESCO.

This document recommended that member states promote and support the construction of capacities for the production of Indigenous content on the Internet. It also extended several invitations to promote the incorporation of Indigenous Internet content.
2.2.9 Resolution 46 (Doha 2006) on Indigenous peoples.

This resolution, issued by ITU, drew attention to the Global Initiative on Indigenous Peoples and recognized the problems that affect them worldwide, incorporating measures to promote sustainable and accessible universal access to ICTs. The resolution dictates that all of those actions shall be done in a framework that allows ICTs to contribute to Indigenous peoples’ development, according their cultural heritage and values.

ITU has also published two additional resolutions related to Indigenous peoples. Resolution 11 addresses connectivity in rural and isolated communities, where Indigenous people usually live. A second resolution, adopted during the World Telecommunications Development Conference 2010 in Hyderabad, focuses on strengthening the technical capacities of Indigenous peoples in telecommunications.

2.2.10 Resolution PCC.I/1 (XV-01). Issued by the Inter-American Commission Telecommunications through the CICC.

This resolution addressed a series of recommendations about plans for the development of telecommunications for Indigenous peoples. The goal was to provide a comprehensive vision for the creation of an enabling environment of ICTs for Indigenous peoples. The resolution sought to take into account such factors as technology, skills training, content, and administration of services, among others.
2.3 Indigenous peoples and ICTs

Until now, this toolkit has provided an overview of the situation of Indigenous peoples in the world and their rights to ICT capabilities. On one hand, the difficult situation Indigenous peoples face in their development efforts has been illustrated. These difficulties often result from the expropriation of their lands and resources or the lack of recognition of their languages, customs and values. On the other hand, we have seen a series of Indigenous rights being recognized, giving Indigenous peoples the ability to decide upon their own forms of development in accordance with their ancestral cultures.

ICTs are central to this contradictory situation. On one hand, the indiscriminant dissemination of ICT media, such as television and radio, have altered the values and customs of these peoples by introducing hegemonic cultures into their communities. But these media also can introduce content oriented toward Indigenous people, tangibly contributing to the conservation of their cultural heritage. One example of such programming is the Telecentre Port Saavedra, located in a Mapuche community in Chile. The telecenter uses ICTs to inform and promote natural telemedicine. Native healers can use the Internet to connect to distant communities and to practice their ancestral knowledge.

There are also Indigenous broadcasters in Australia, New Zealand and Canada that produce and transmit programming appropriate for the cultures and development needs of their Indigenous populations.

New technologies can become important allies in the economic and social development of these peoples. Experience has shown that telecommunication access centers run by schools or community associations promote local-interest content, disseminating the values and the worldviews of the local people. In this way, they become mechanisms of ethnic expression and education, decreasing technological "apartheid" and alienation.

In Peru, for example, Indigenous people have used the Maranon Community Radio station to denounce the conflicts and murders perpetrated by the state and by businesses interested in the exploitation of Amazonia. The allegations of such crimes have pierced the airwaves, traveled around the world and led to the establishment of a process of dialogue between the different parties.
This adoption of current technology is still recent and innovative. While many Indigenous people remain unaware of the existence of these tools, some have already embraced the possibilities these technologies present.

Among young people, ICTs are undoubtedly an attractive tool. In fact, young people consider them a necessity. ICTs exert a fascination that captivates younger generations almost instantly. This has been the case with such initiatives as the E-Way in Laos, where young Tibetans form part of the less than 15,000 who use the Web in Laos. This situation has facilitated employment and learning opportunities for this group.

Among older generations, however, attitudes are different. Interaction with technology often generates resistance and fear of loss of culture and tradition.

For leaders such as Margarita Neuculen, a traditional herbalist among the Mapuche people, the technological path can provide balance, because the technology itself may lead to liberation. The challenge is to blend ancestral knowledge with innovation, preserving ethnic identity and traditional ways of life in the face of the contemporary world.²

The task, then, is to find a balance that allows ICTs to function within the scope of the development objectives that the Indigenous communities themselves have identified.

**Recommended Reading**


² Carvin, A., Surman, M. (Editors),? "From the Ground up; The Evolution of the Telecentre Movement", telecentre.org, IDRC, SDC (2006).
3. What is the role of governments in creating an ICT enabling environment for Indigenous Peoples?

The creation of an enabling environment means providing the conditions necessary for ICT projects to be adequately developed and sustained. Often, connectivity projects destined for Indigenous zones emphasize their long preparation, yet major investments often are made in facilities that may be abandoned within a few months. Other projects get off the ground using government support and yet never become self-sustaining. Still others become successful projects in small locales but never succeed in extending their reach over wider areas, wasting their full potential.

The goal is to build sustainability using a firm foundation at the very beginning of each project. That way, the goals of each community can be achieved by supporting incremental development along the way. This section of the module explores the ways to create an enabling environment for sustainability of ICT development in Indigenous areas.

3.1 Introduction

In order to create an enabling environment for ICT development, the following areas of work for an appropriate connectivity program have been identified:

- Regulation -- to provide a conducive, legal framework for the proper functioning of the project.
- Technology -- to provide favorable development of appropriate technology in remote areas, so that the technological tools best fit the needs and characteristics of the community.
- Industry -- to provide an economic environment that allows for the development of upstream services and industries in remote areas that offer affordable and quality services to the access centers.
- Content -- to construct and implement a series of factors allowing the creation, dissemination and distribution of local content.
- Capacity-building -- to develop organizational schemes, agents and competencies to ensure that Indigenous communities have the skills needed to incubate, develop and sustain school-based access centers.
- Participation - to ensure the effectiveness of tasks carried out in all the areas outlined above.
This section will continue to chart a path that touches on all the areas of an enabling environment. The path leads from the national level to the local level and back again. Finally, this section confirms the need to work at all levels in order to attain sustainable networks that contribute to Indigenous peoples' achieving their development objectives.

**Recommended reading:**


**3.2 Regulation**

Regulation provides the basis for an enabling environment for ICTs in Indigenous communities; it is the first element to address in creating such an environment. The key points cater to the normative content necessary to stimulate the coverage, the availability of frequencies, the financial sustainability of the media, the promotion of Indigenous content and the participation of Indigenous peoples in the design, implementation and evaluation of policies that directly affect them.

**3.2.1 Key Regulatory Elements**

Several countries have incorporated these elements in their legislation, although the manner in which they have been incorporated varies according to a country’s particular historical, political and social conditions. As a way to identify best practices, this section has chosen to feature Canada, one of the countries that has incorporated these elements, to a greater extent than others, in its legislation.
3.2.1.1 Universal Service

The development of ICTs in Indigenous communities usually occurs with great difficulty. Access problems and low profitability of access networks often mean that network deployment is unattractive for telecommunications companies. So there is a need to apply norms related to universal service in order to ensure the provision of infrastructure for these areas. The provisions in this issue are varied; however, Canada is notable in making a universal service guarantee for its citizens that has brought broadband communication even to its more remote areas.

Clear regulations and policies on universal service are needed for school access centers, to ensure the availability of affordable Internet access and the evolution of broadband services.

3.2.1.2 Spectrum Management

Proper spectrum planning should reflect national priorities and international goals represented by the WSIS agreements and other documents. Indigenous peoples’ communication needs have to represent a top priority, which must be reflected in planning. As in the case of universal service, governmental provisions are varied and cater to national strategies. Some countries like Argentina, in the case of Indigenous communications broadcasting, have reserved areas of the spectrum for Indigenous radio and television.

Another important aspect in spectrum planning is ensuring availability of frequencies for communication in remote areas. In Nepal, the transition from a highly restrictive monarchy resulted in the availability of greater incentives and freedoms. This led to the granting of licenses in the 2.4 GHz and 5.8 GHz bands. Licenses were given for VSAT and ISP services in rural areas, at a nominal cost of about USD 2 per year. All charges for voice over IP (PC-to-PC and IP-to-IP\(^3\)) were eliminated. All of these actions culminated in facilitating the deployment of communication in rural areas.

In the same fashion, in Africa, countries like Kenya, Uganda, Tanzania, Ghana, Ivory Coast, and Nigeria have adopted regulatory measures to facilitate VSAT communication, allowing more widespread rural communication at more accessible costs.
The element of establishing enabling regulation through appropriate spectrum management helps to promote community access centers located in schools. Proper spectrum management ensures the availability of frequencies for centers' connectivity and for the evolution towards more advanced communication systems or means of communication that can be developed by the communities themselves.

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3.2.1.3 Support on training and equipment acquisition

This element ensures sustainability of the centers, facilitating the presence of technical personnel in the area who can maintain the network, update and develop centers, and produce local content material.

In Bolivia, federal resources are allotted to purchase and modernize equipment in the community radio stations. With this incentive, coupled with training actions, the stations of Indigenous communities are being transformed into local connection centers.

In Brazil, the Culture Points project offers multimedia equipment, such as video cameras, laptops and projectors, for Indigenous associations. In this case, training occurs in regional encounters with youth leaders and also virtually, using free software tools.

Further south, in Uruguay, the law governing community media directs telecommunications officials to support and train employees of access centers. This legislation has facilitated Indigenous groups' access to technological innovations.

3.2.1.4 Protecting and promoting the production of indigenous content

The following essential elements must be included in any regulation that promotes production and protection of Indigenous content:
• The recognition of multiculturalism and multilingualism, as well as the state's interest in their protection.
• Incentives for Indigenous content production.
• Information availability and transparency, avoiding unnecessary obstacles to accessing content.
• Ensuring conditions for the dissemination of Indigenous peoples' content through state-operated or franchised radio stations, and
• Support for the establishment of Indigenous media.

The compliance of legislation with these characteristics enables access centers installed in schools to find relevant content and provides incentives for production of local programming, including educational content that can contribute to multicultural education.

3.2.1.5 Participation of Indigenous peoples

Consulting Indigenous peoples and promoting their participation in debates over the issues that affect them is a fundamental responsibility. So it is the basis for any design and implementation of public policies aimed at helping Indigenous people. The design and implementation of media is no exception.

Moreover, regulations to ensure participation have to be successful in two key areas: (a) participation in the design of programs, policies and policy regulation; and (b) participation in the design, implementation and evaluation of projects implemented in their communities.

With respect to the latter, some countries have implemented permanent consultation and participation bodies, as is the case of the Te Pini Kōkiri (Maori Ministry of Development). Te Pini Kōkiri is the main consulting body representing the Maori people to the New Zealand government, as well as an advisor to the government on all public policy issues related to the Maori people.

Nevertheless, many countries, and especially on the African continent, have more work to do in enacting legislation and recognizing the existence of Indigenous peoples in their territories. Kenya's government has taken this step in recent years.
There are other notable regulations, such as those in Argentina, which establish the participation of an Indigenous representative in the Federal Council of Audiovisual Communication, which is the advisory, consulting and supervisory body of the Federal Audiovisual Communication Services Authority.

Finally, one of the most important elements is to incorporate community participation into the general practice of communications development in Indigenous communities throughout all phases of projects. These issues will be addressed in the relevant section of this toolkit.

3.2.2 Best practices

After reviewing several key regulatory issues, some best practices can be identified. Establishing one overriding, general best practice system would be impossible, since countries have different characteristics. Moreover, the regulations involved in a project of this nature are highly diverse, making it very difficult to untangle the legal fabric that allows ICT development in the Indigenous communities of a given country.

Without doubt, the Canadian regulatory approach is an example worth highlighting. It incorporates universal access rights, consulting and participation schemes that conform to the daily practice of public policies on indigenous issues, financing schemes for communities, and indigenous peoples’ television systems. These are just some of the elements articulated in a legal and public policy system conducive to the development of ICTs in Indigenous communities.

3.2.3 Evaluation of Regulatory Elements

It may be useful to analyze a given regulatory system using the checklist provided in the chart below. As noted in the previous section, the key elements can be incorporated in various ways into regulatory systems. Therefore, it must be pointed out that some of the questions included on the table below would have no application in some regulatory systems.
<table>
<thead>
<tr>
<th>Elements included in the regulatory system</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Includes provisions on universal service</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Includes specific provisions on Indigenous communities' coverage</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Includes disaggregated information on coverage in Indigenous communities</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Includes a specific program on Indigenous communities’ coverage</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Establishes spectrum reserves for Indigenous broadcasting</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Incorporates state obligations for the promotion and production of local content</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Incorporates obligations for broadcasting concessions with respect to Indigenous content</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Includes consultation and participation bodies for Indigenous peoples’ telecommunications</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Includes obligations on consultation and participation in the implementation of projects</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Includes a regulatory approach aimed at ICT development in remote areas</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

3.3 Infrastructure and Technology

Infrastructure and technology are generally the most salient elements in ICT development policies for remote areas and Indigenous communities. In many cases, the policies achieve only the build-out of infrastructure that is later abandoned or underused. Therefore, technology adoption is, without a doubt, an essential element to be considered, with the most appropriate technology being matched to any given locality.
In order to determine the key aspects of technology selection, we have to consider the preconditions of public policy that allow for the development of infrastructure. In the same vein, we also must consider the methodological aspects that have to be incorporated in the development of ICT projects.

With respect to the latter, the model of Percoladora of Mallaeu & Rocke has been taken as a base, which indicates that the selection of a technological solution must be addressed in three areas:

1. The base domain, which refers to the political and cultural context;

2. The user domain, which refers to the social context; and

3. The technology domain, referring to the physical context.


3.3.1. Key Aspects of public policy

Using these domains, the toolkit will separately explore the key aspects of public policy and implementation of projects.

3.3.1.1 Flexible framework that takes into account the local context in the selection of technology

The public policy framework must establish implementation and development stages to enable the analysis of needs and conditions that will be used later in the selection of appropriate technology. In this regard, programs that automatically negate all possibility of selecting new technologies have no place.

The existence of programs wedded to a particular technology leads to problems that can be exemplified by a case in a country in the Americas, where VSAT antennas were chosen for the national community access centers programme. This ignored the fact that there were communities where broadband was available via cable or fiber optic and others where weather conditions made VSAT an unsuitable technology. During the next phase of the programme, the connectivity centers had to adopt other types of technology with greater capacity and better economic efficiency -- where they could. All in all, this process led to unnecessary expenses that could have been avoided if local circumstances and needs had been identified and taken into account before determining which technology to use.

Conversely, projects such as the Canadian National Research Project for the First Nations on Telehealth, indicate the technology to be adopted only after carrying out an appraisal of local needs and going through extensive planning with local users.

5See Community Services in the 21st Century: First Nations & Inuit Telehealth Services, Canada 2001
3.3.1.2 Fostering technology adoption

The adoption of technology takes place when the need is combined with the tool, and the community personalizes the technology in order to meet its needs. The same technology is further leveraged as users identify other needs that it can meet. Therefore, the process must go step-by-step, identifying needs incrementally and identifying how technology can meet those needs. Gumucio Dagrón describes this process clearly in the following sentence:

I always say, to buy bread on the corner you have to go on foot, to go five blocks take a bicycle and to go a kilometer perhaps take the bus, but do not start with the bus to go to buy bread on the corner…

Indeed, there are cases in which the availability of resources leads to the installation of systems that go beyond the needs of the community. Or, sometimes systems installed are overtaken by the needs of the community because they did not allow for later transition to more advanced technology.

In other cases, given the local conditions and the availability of resources, many communication centers work with equipment that might seem obsolete but actually works well in that situation.

The Guarani Communication Unit (UGC) works in the realm of audiovisual production using equipment that today can be considered obsolete, but it is the only available. Currently, no production equipment in digital video is available… For audio-visual records two VHS Panasonic, (the M900 and the M1300) are used. One difficulty with such apparatus is maintaining battery life when they are being used in areas without electricity. For this reason, a 12-volt motorcycle battery was adapted to a VHS battery in order to obtain a long-lasting energy generator. The UGC team took advantage of such field obstacles, which imparted valuable experiences and learning and which ultimately resulted in greater group cohesion⁶.

As shown by the example in the technology component, the most important aspect is ensuring that the community adapts the technology creatively and according to its needs.

⁶ Yasarekomo: An Experience in Indigenous Communication in Bolivia, FAO 2004 p.20
http://www.fao.org/docrep/006/y5311s/y5311s00.htm
3.3.1.3 Infrastructure

At this point, this toolkit has focused on two aspects: (1) the creation and sharing of community infrastructure and (2) the establishment of connectivity infrastructure in more populous locations or bases, from where wireless communication can be deployed.

With respect to the first aspect, it is important to consider that many remote areas lack basic infrastructure, such as electricity. This problem in itself determines some of the characteristics of the equipment that is to be used. There is also the need to share the prevailing infrastructure with other users. So it is important for digital telecenters to utilize and also strengthen existing infrastructure. Because of this aspect, sometimes it is convenient to install digital centers in schools or other pre-existing media centers in the community, such as community radio stations or post offices, assuming care is been taken to ensure collective access to these centers.

Regarding the second aspect, it is important to consider that it is difficult and uneconomical to have access to fiber optics in all locations. However, if fiber nodes are available in nearby cities, it is easier to provide wireless broadband connections from those points to surrounding communities. Such solutions have proven to be an excellent path to the development of broadband connections to remote locations. Examples of this type of solution are found in India, where each taluka (county) avails itself of broadband connections with wireless coverage in order of 20 or 30 km radius.7


3.3.1.4 Technological Research

The characteristics of rural areas require the development of systems and specific equipment, incentives for research, development of local capacity for innovation of equipment and networks, and the creation of commercial opportunities for the provision of services in these areas. All of those actions stimulate the creation of equipment that meets local needs.

The technology developed for remote areas must possess at least the following features:
• Cost-effective
• Accessible
• Robust
• Scalable
• Capable of accepting the applications considered relevant.

An example of the development of technologies suitable for specific conditions is the CorDECT system developed in India, which is capable of operating at 55°C. This avoids additional requirements such as air-conditioning. It also requires only 1 kilowatt (KW) of total energy consumption. With these adaptations, CorDECT can simultaneously offer both voice and Internet access at 35/70 kbps to locations within a radius of 25 km.

Public policies for ICT development should be flexible, allowing the choice of technology to be made on a case-by-case basis. They should encourage participation by allowing needs to be shaped by whichever technology is to be adopted. Developers should build infrastructure for the deployment of networks in surrounding areas and/or those most difficult to access. They should share existing infrastructure within communities, and they should promote research and technological development for communication in remote areas.

Recommended reading:

• Jhunjhunwala et alt., *N-Logue The Story of a Rural Service Provider in India*


3.3.2 Methodology for implementation

As mentioned at the beginning of this section, the Percoladora of Mallaue & Rocke (2007) model will be considered as the basis for the key elements in the area of technology application. The model indicates three bases for selection of appropriate technology, each of which provides characteristics, expectations and needs that have to be taken into account in selecting the technology that could meet those needs.
This analysis is performed in three stages that provide data about the context in which a network or equipment would be installed, the possible uses that the network will be given, the characteristics of users and the various networks or protocols available in the area, along with essential data for the choice of appropriate technology that is to be used.

3.3.2.1 Base Domain

In this section, the developmental objectives of the community are determined within its particular political and cultural context. To do that, an integrated analysis is done of the distinctive micro and macro factors that determine the prevailing cultural systems.

At this point the analysis must consider three aspects:
1. The *available resources*: These are the natural resources, technologies, skills, knowledge and capacities, access to education, sources of credit and social networks.
2. The *resource context*: Whatever limits or, conversely, provides access to and use of these resources, and what?s more, the political, economic and technological tendencies, events such as disasters, epidemics, permanent and transient social movements and seasonal cycles, productive factors and prices, etc.
3. The *social environment*: The political realities and institutions that affect the ways in which resources are used.

For this analysis, there are varying methods. One of them is known as "Sustainable Livelihoods," which incorporates various analytical tools that allow for the identification of the aforementioned characteristics. But in general, any participatory appraisal methods that cover the mentioned areas can be applied.

To better illustrate this point, consider the problems of distributing agricultural products in Zambia. Despite the fact that farmers in this nation are considered to be the best in the world in the production of some products such as cotton, they face unscrupulous buyers who pay below the market price, taking advantage of the difficulties that grain producers encounter in finding adequate markets for new
products. Once this problem was analyzed and understood as a development priority, mobile telephones (i.e., texting) were deployed to give farmers access to accurate market prices and buyers.⁹

In other words, the analysis performed in this area determines the development objective to be achieved and determines the context in which technology will be adopted. This, in turn, acts as a first filter in order to rule out or identify appropriate technological tools.

⁸ International Fund for Agricultural Development (IFAD) offers several materials on sustainable livelihoods [www.ifad.org](http://www.ifad.org)


### 3.3.2.2 The User’s Domain

In this section, the characteristics of the user are considered in order to define the type of applications that can be used and that are required. For example, if in any given community the majority of the people are illiterate, it is likely that the use of audio and video tools will predominate. The working capacity of the system must, then, allow for the use of audio and video applications. The same capacity would allow for the operation tele-consulting, pc-to-pc video links and the sending of images under secure conditions. In additional to the users’ needs, it is expedient to take into consideration the technical capacity of the network administrators.

In northern Uganda -- a zone of conflict, in which there are several refugee camps -- a WiFi network has been developed to communicate among the camps and with the aid organizations that work in them. This network has been developed through the BOSCO Uganda Relief Project (Battery Operated Systems for Community Outreach) and the social enterprise Inveneo, which incorporates the participation of users as a key element in the design of the network. This project took into account, for example, that the network would be operated by non-technical administrators with little experience in use of ICT. Therefore, the infrastructure had to incorporate easy-to-operate equipment.
3.3.2.3 Technology Domain

This section reviews the availability of technology that meets the needs identified in the previous sections. Additionally, the most appropriate type of technology is determined according to the physical context in which it will operate.

The technologies include access technologies, access devices and applications. They are evaluated in accordance with the results obtained in each of the areas analyzed.

In examining access technologies, we review their availability and whether they can provide appropriate services to suit the region and the users' characteristics. In this way, it can be decided if a fixed telephone, mobile phone, radio, television, fiber optic, cable, PLC, WiFi or WIMAX technology is to be adopted and used.

Access devices are the mechanisms through which users interface and obtain information. In choosing the appropriate devices, the following characteristics must be taken into account:

- User characteristics
- The environment in which the technology operates, including physical conditions,
- Price,
- Availability,
- Ease of use,
- Mobility, and
- Energy consumption.

The applications in question refer to the software or utility that will be provided for the access devices and the network. At this point, in addition to the arguments arising from the user and physical contexts, it is important to consider the elements in the basic environment that will define many of the benefits or tele-applications. These may be directly related to development priorities.

Here we can return to the example used in the Base Conditions section: the Zambian grain producers for whom the developmental priority was access to markets. In that case, the producers had access to
the mobile telephones at an affordable cost. Even though they also had access to the Internet through a portal at a digital community center, the most accessible and sought-after technology, considering the physical characteristics of the place and users, was the cellular phone.

This analysis is very relevant to the construction of an access center at a school in an indigenous community. Before building any such center, the questions that should be asked are: What is required? Who is going to use it and for what purpose? What are the geographical features of the area? Answers to these questions should dictate the characteristics of the network, equipment selection, required applications and, as we have seen, the creation of capacities for the use of the technology.

Recommended reading


3.3.3 Best practices

The best practices in the field of technology and infrastructure will be presented in the same way as the Key elements. The best practices with regard to public policy will be discussed first, followed by those in the field of methodology or organization for the choice of appropriate technology.

With respect to public policy, the experience of Canada in the National Research Project on Telemedicine in the First Nations has been noted, as it incorporates a broad research phase in order to determine appropriate technology. All the characteristics that have been highlighted are included, and results in the provision of technology and specific equipment for each of the Indigenous communities have been selected, commensurate with their needs and characteristics.

With respect to methodology, it is interesting to point out the work in technology selection adopted by the Nepal Wireless Networking project, which was presented by ITU Study Group 2 in the theme of
rural communication. This community project initiative is an example of technology selection that incorporates many of the elements mentioned in the methodological part of this document. Moreover, it represents the clearest application of the phrase uttered by Albert Einstein, “Imagination is more important than knowledge.”

The Nepal Wireless Networking project arose from the aspiration of several communities to find ways to connect themselves with the nearest city\(^{10}\), Pokhara. At the start of the project, two European volunteers brought two wireless cards, with which they began to experiment, using some homemade antennas. Before this, local people had already sought other options such as VSATs, satellite phones and microwave antennas, but the community was unable to cover the cost of such technologies.

At the time that the project was launched, WiFi technology was new, and it was not known if it was effective over long distances. The telecommunication engineers, with whom the community of Nangi was in contact, thought it was impossible to bridge the 40 kilometers between Nangi and Pokhara. However, tests were successful, and the community chose to adopt this technology for several reasons: (1) it was the most economically viable technology on the market, (2) it was the easiest to learn to use, (3) it used very little energy and therefore was easily adapted to solar energy and, (4) the cost of operation and maintenance was minimal. At the time of the report of the study group, the equipment operated by the community\(^{11}\) was Motorola Canopy, which employs spectrum in either 2.4 GHz or 5.8 GHz bands for long distance.

After its commencement, this project received international financial support from ITU and other bodies for the purchase of equipment. Today, the project has become a community company directed by a secondary school in the region. The project now provides the district of Myagdi Nepal with educational support, telemedicine services, local electronic commerce and VoIP telephony.

The community followed a logical process to select the technology – something that government agencies sometimes fail to do when establishing national communication programs in remote regions.

The challenge for Indigenous peoples is to ensure that new technologies are culturally adapted to the specific needs of each community. Therefore, the selection and deployment of the technology to be used has to be tailored to benefit Indigenous communities. Otherwise, connecting the community can run counter to community values, such as autonomy, that Indigenous communities seek to strengthen.
Moreover, the sustainability of the project will undoubtedly be affected.\textsuperscript{12}

\textsuperscript{10} For example, the Indigenous community of Nangi where no phone, internet or health services is to be found, is two days away from Pokhara on foot.

\textsuperscript{11} For more information about the network infrastructure consult the Study Question case study: 10-2/ID227


### 3.3.4. Self-evaluation

This section will help verify whether the ICT development policies and programmes in remote communities encourage technological adoption by indigenous communities. The inclusion of these practices will ensure that the technology chosen is adequate for the characteristics and needs of the community, as well as for the project’s technological sustainability in the long term.

<table>
<thead>
<tr>
<th>Practices that encourage community adoption of technology</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>The national connectivity programmes for remote areas allow the choice of technology in accordance with the characteristics of the community</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The specific traits of the community are taken into consideration during the implementation of the project</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>In the selection of the technology to be used, the development priorities of the community and the country are taken into account</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Parameters are in place to verify that these local and national priorities have been taken into account and monitored through e-applications</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
In the selection of the technology, the needs and capacities of the users are taken into account

Parameters are in place to verify that these needs and capacities have been taken into account with respect to the infrastructure and applications

In the selection of the technology, the physical context and market in which it is to be applied/used are taken into account

Parameters are in place to verify that these needs and capacities have been taken into account

Incentives are in place that stimulate research in technology for communication in rural or remote areas

In general, the individual traits of the community and are taken into account, and participation is assured in the definition and selection of the technology to be used.

### 3.4 Industry

It is notable that remote locations represent unattractive markets for telecommunication companies. However, ICT industries can be established in remote areas through attractive business schemes that expand telecommunication coverage in those remote areas without the need for subsidies.

What, therefore, are the elements that stimulate viable and attractive business plans for developing ICT infrastructure in remote areas and in Indigenous communities? What is the role of government in generating them? Prior to exploring the answers to these questions, it is necessary to understand a fundamental idea with respect to economic matters. According to Braudel?ś model, there are three levels of economy, each capable of fully satisfying human needs, and with specific institutions that are suitable for each specific economic environment. The three levels are: the subsistence economy, the local economy and the global economy.
Commonly, telecommunication coverage schemes do not mesh with this model, and companies that operate in the global economy often attempt to operate in areas with subsistence economies. This requires large subsidies, instead of generating the conditions necessary to create infrastructure suitable for this kind of economy.


### 3.4.1 Key Elements

At this point, the essential elements that allow community access centers to become successful will be examined, including which factors make the centers sustainable and which allow scalability in the provision of services. The toolkit also will examine the actions that states should adopt to facilitate the development of ICT industries in sustainable rural settings.
3.4.1.1 Using a model based on economies of scale

In planning technology expansion in rural communities, it is necessary to examine the whole chain of production, its key actors, and the economic levels in which each operates.

For example, the last link in the chain is the community center, which usually operates in a subsistence economy. Monetary resources are scarce, but important economic resources can be found in the community’s inhabitants and their organizations.

In this economic setting, however, it may be difficult to find certain resources that community access centers require, such as technical advice, equipment maintenance, peripherals and other items. These must be sourced from outside the immediate economic environment -- from a higher economic tier (the local economy). It is important that these resources are obtained at the local level and not at a global level, which is often cost-ineffective.

Finally, access to the main backbone network can only be managed by a company that is present in the global economy, since the backbone usually is beyond the reach of local service providers.

The design and implementation of connectivity programs in remote areas must take into account the productive chain described above, and the manner in which actors are coordinated or motivated. This will be looked at later in a representative case study.

3.4.1.2 Stimulus to the development of local companies

Once the implementation plan has taken into account the ICT productive chain, it is very likely that micro-entrepreneurs will require incentives or subsidies for its growth and investment. It is possible that there may be groups of willing people who want to employ themselves as installers and provide maintenance or develop software. In spite of their interest, they may lack the skills, materials and/or funds to respond efficiently to the demand or business opportunities that present themselves.

In this sense, business incubators have proved useful for the development of micro-enterprises to meet communication needs in remote areas. An example of such a program is the Indigenous
communications initiative My-Knet, which is supported by the Smart Communities Industry of Canada Program. It began as a system of personal paging services for Indigenous communities of northern Ontario. Today, the initiative boasts a system of broadband communications with multiple applications.

The successful development of micro-enterprises requires access to four essential elements:

- Finance - access to monetary resources;
- Knowledge and technical support;
- Logistics for buying and selling (access to markets for inputs and the possibility of product placement); and
- Ability to share risks.

There are multiple ways of ensuring access to these four elements, depending on national circumstances and the resources available. However, it is necessary that all programmes incorporate the four elements.

3.4.1.3 Technological Neutrality

Micro-enterprises operating in Indigenous areas are generally technological innovators. The application of strict quality and service standards can halt the addition of new competitors in this market. So it is important to incorporate internationally accepted principles and technological neutrality in order to avoid a slowdown in the use of certain protocols or technologies for purposes not previously foreseen.

3.4.1.4 Access to essential facilities

Community-level industries require access to essential server facilities and backbone lines, which are usually operated by companies that operate at a global level. It is crucial, then, that micro-enterprises providing telecommunication services in remote areas operate under competitive conditions in order to guarantee community access to communication networks.

Recommended reading
3.4.2 Best Practices

Several countries have opted to eliminate barriers or provide facilities for the development of small social enterprises and social organizations that provide telecommunication services in remote areas. Known in academic circles as micro-telcos, these are small businesses, often organized into associations, which in Argentina (for example) serve about 8 per cent of the domestic market. The groups operating micro-telcos are organized in different ways, either by community inhabitants, local or community governments, or even companies specializing solely in this type of coverage.

A good example of a micro-telco is India’s N-Logue, which (among others) received a 2005 WISIS prize. But there is no current information on N-Logue, and even some of the academics in India who have researched the case were unable to indicate whether the company still exists, if it had been taken over, or if it had simply changed its name. Nevertheless, the need to examine its recent performance with greater scope -- along with fact that N-Logue represents many of the best practice recommendations made here -- has led to its incorporation in this text.

N-Logue is located in India, the second most populous country in the world, where the state telecommunications company has managed to install fiber optic cable in almost every county (talukas). This, in turn, has laid the foundation for extending telecommunications to close-proximity villages (some 300 to 500) within a 30-km radius. The possibility of finding trunk-line infrastructure with which to connect has, without doubt, facilitated the establishment of a company that has been able to connect the surrounding villages through a wireless network.
Although basic infrastructure is certainly important, it is of little use without an appropriate business model. The starting point for N-Logue's business strategy, which the state telecom company also adopted, was to overcome the problem of providing universal service (even in urban areas) by installing assisted telephone operators in stores located no less than 50 meters from a residential zone. This contributed to the creation of a base of micro-enterprises and telecommunication service users that, at the beginning of the new millennium, represented 25 per cent of national, telephone-based communication income.

The first link in this business chain is the Internet kiosk, equipped with a computer, Internet connection, printer and some other accessories such as a Web camera. The kiosks are administered by an entrepreneur from the community, who is normally a young woman who may, or may not, have prior computing knowledge. The Internet kiosk installations are supported through bank credits that can be covered by the income generated by the micro-enterprise.

The second rung on the service ladder requires a service supplier that meets one of the Internet kiosk's needs, which might typically be equipment repair and maintenance, virus elimination or service connections. Such actors are known as local service providers (LSPs), which are located in each county so that they can respond to any service request within 90 minutes. The LSP plays an essential role in providing connections and reconnections, maintenance and training to Internet kiosk operators. The LSP is an N-Logue partner and is located at the access tower.

Finally, the last link in the service chain is N-Logue itself, which provides access to the network backbone. It coordinates with application providers and content technology providers, trains LSPs and Internet kiosk operators, supplies Internet kiosks with software and hardware, and collaborates with public policy formulators in order to ensure quality service and to develop the markets that support the LSPs and Internet kiosk operators.
As can be seen in this example, all of the recommended elements are incorporated. There is a business design that contemplates economies of scale. Each operator does its part, community centers have access to financing and technical assistance, and there is access to a backbone network.

Argentine telecommunications cooperatives are also a good best practice example. In most cases, community initiatives offer quality services at lower costs than global communications or national suppliers do.

3.4.3 Self-evaluation

The table below assesses whether there is an enabling environment for the development of industries that can provide telecommunication services in remote areas. These industries contribute to the community access centers – including those located in schools -- and locate necessary services at accessible prices and at accessible distances for the development of their activities. In sum, these industries become telecommunications services suppliers to neighboring populations.
### Practices that contribute to the development of an ICT industry in rural areas

<table>
<thead>
<tr>
<th><strong>Yes</strong></th>
<th><strong>No</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectivity plans consider the participation of community organizations or social companies or non-profit organizations for the provision of telecommunications services in remote areas (micro-telcos).</td>
<td>?</td>
</tr>
<tr>
<td>Connectivity plans consider incentives to community organizations or social companies or non-profit organizations for the provision of telecommunications services in remote areas (micro-telcos).</td>
<td>?</td>
</tr>
<tr>
<td>Connection plans consider the creation of local companies that provide maintenance and service to community access centers.</td>
<td>?</td>
</tr>
<tr>
<td>Accessible funding exists so that micro-telcos can start, expand or improve their services.</td>
<td>?</td>
</tr>
<tr>
<td>Access to the backbone network, at affordable prices, is guaranteed</td>
<td>?</td>
</tr>
<tr>
<td>The adoption of new technology is facilitated while taking into account the special characteristics of these areas.</td>
<td>?</td>
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</tbody>
</table>

### 3.5 Local Content

Content creation is a topic with various implications. In fact, there is a multiplicity of agreements and studies on the subject of content creation among Indigenous communities. This constitutes a clear demonstration of the importance of content for Indigenous people to exercise their freedom of expression and cultural rights.

In this section, the theme of the content creation will be addressed in two ways: (1) from the perspective of the creation of an enabling environment for the development of content and, (2) from the perspective of what elements should be considered in facilitating the production of content in school-based community access centers located in Indigenous communities.

Before defining the key elements, it should be noted that connectivity planning often leaves out program content. This is like building a road without having any vehicles to travel on it. A national connection plan must be accompanied by a plan to develop content.
It is also necessary for community access center plans, or connectivity through schools, to address this issue, although the need to do so often appears when projects are at a more advanced stage or when the center has been linked to other means of communication, as will be seen at a later point. The production of local programming usually signifies the evolution of community access centers from an information access vehicle to a vehicle of media communication and, while this jump is desirable, it is not easily done.

3.5.1. Key elements

In order to explain the key elements, it is best to start with those relating to the creation of an enabling environment for local production. This will be followed by an exploration of factors to be taken into account for the installation and operation of community access centers in Indigenous communities.

3.5.1.1 Key elements of an environment conducive to the development of local content

The following elements in the creation of an enabling environment for the development of local programming should be expressed in a plan or national agenda for local or multicultural content.

- Ensure conditions throughout the cycle of Development of Local Content: All content is part of a cycle, and each part is related to the cycle in its totality. The cycle can be portrayed as follows:
For a better understanding of what is being described, let's look at a hypothetical example based partly on actual experience. In this example, it has been decided to create indigenous video centers in order to train members of Indigenous communities in the production of cinema and video films. However, as it turns out, no movie theaters will project the films, mass media outlets ignore them, or the productions are used without consent, because mechanisms do not exist to ensure copyright enforcement.

As a consequence, investment in this case has little effect, as it impacts narrowly in the exercise of cultural rights and freedom of expression. As a result, actor communities and general society have limited access to the resulting content. In other words, the objective of communication is not met, since broadcasters and recipients are few in number.

For that reason, in designing a national plan to produce local or Indigenous content, action must be taken at all stages of the cycle: training, production, distribution and enforcement of regulations.
3.5.1.2 Market creation

All local content policy needs to ensure the creation of a market for the distribution of products. Mechanisms for doing so can be varied and are often achieved through their inclusion in local broadcasting obligations that may be commercially beneficial to both sides.

For example, in Mexico, cable television concessionaries are obliged to incorporate at least one hour a day of local content into their scheduling. When this policy was first implemented, the concessionaries were reluctant to fulfill this obligation, but they realized that this gave them a competitive advantage over other television service providers, because local populations prefer local programming in their scheduling. Today, it is possible to find local Indigenous productions on some cable TV channels installed in Indigenous areas.

Another way of generating a market is to ensure the contextualization of communication campaigns destined for Indigenous populations. The government also benefits by ensuring that the recipients more easily understand its message.

Ways of creating markets are manifold, and include festivals, promotion of Indigenous educational content and local production subsidies, etc. Their selection depends on the characteristics of each country and the organization of the various distribution channels in it.

3.5.1.3 Appropriate Public Policy

The aspects of public policy that should be included in order to stimulate the promotion of local content programming are varied. Actions should emphasize the need for clear and measurable objectives that must cover the whole cycle of local content development. This means knowing whether the development objectives help fulfill a local content production policy, which can extend from strengthening cultural values of a particular sector to positioning their products in a given market.

In the case of access centers located in schools, some educational activities provide an excellent opportunity for the creation of local content. There have been numerous interesting initiatives within formal and informal education that have been developed from work carried out by children who have
produced stories, 15 films 16 and videos 17 that can then be incorporated as educational material.

15 “WordMakers” is a rural education initiative that works with stories created and illustrated by children from rural schools. http://www.youtube.com/watch?v=DYfMyqVhY0g.

16 “Holy Hit” is a multiple awarded short film by Dominique Jonard which was produced with children’s drawings and narrated by Indigenous Chamula children http://www.youtube.com/watch?v=DYfMyqVhY0g.

17 “Window to My Community”; is a series of educational videos with children from various indigenous communities and cultures present their communities. http://ventana.ilce.edu.mx/

3.5.1.4 Training and availability of means of production

For production purposes, it is essential that Indigenous communities be able to count on trained members of their communities. Indigenous peoples have shown great ability in the management of audiovisual media, and there are extensive examples of films, videos 18 and Web pages of excellent quality. It often requires just a little training and the means of production to achieve high quality productions. There are abundant examples of success in this field; sometimes it just requires one training event and the provision of the necessary tools for local communities to begin generating local content. This has been the case with Communicators for People, which can be found at the following website, http://www.originarios.org.ar/.

Moreover, it is essential to train individuals to find manuals and courses in Indigenous languages, as well as audio and video tools that can facilitate the required training, as many Indigenous cultures are oral.

18 Guanaba.Net in Cienega, Baharona, Dominican Republic is an important example on how a rural telecenter can develop contents as a result of training offered and community initiatives.
3.5.1.5 Access to Local Production

The Internet has enabled the provision of access to materials that have previously only existed in libraries or public institutions’ collections. Often, Indigenous peoples have been the subjects of such material but have had limited or no access to it. However, the materials in question are now increasingly found online, which allows the Indigenous media to find relevant material that can expand their programming. The digitization of Indigenous productions by academic institutions and governments is undoubtedly an essential element for the dissemination of local content.

3.5.2 Key aspects of production of content in community access centers

In addition to training and the availability of means of production, the development of content depends mainly on the existence of a community communication program that is necessarily linked to the existence of a community life plan or, in other words, a plan for community development.

The communication program has to identify its recipients, the areas or activities that it will support, and the content through which it will do it, as in the following example:

From its inception, the AMCIC Network has developed in conjunction with indigenous councils (cabildos) a strategic plan in order to strengthen the following key aspects of the lives of the indigenous people of Cauca: their mother tongue, community unity, community autonomy, territory and culture, key aspects contained in the Life Plan of the Indigenous Peoples of the Cauca. 19

The raison d’être behind the production of content from an indigenous perspective is always to address the imperative of community development and the community’s life plan. The existence of a community access center in an Indigenous school makes sense to the extent it is incorporated into a life plan and works to fortify it. The plan should cover all sectors of the community (women, young people, the
elderly, and younger children) as well as their different structures (governmental, territorial, productive and educational) and their subsequent communication needs, as in this example:

For this reason, a radio station was created, to transmit Wayúu knowledge from their beginnings, to how the Wayúu adapted to their desert environment, adapting endemic fruits and other wild foods,—the essences of what the radio station should make known in order to strengthen the Wayúu culture. What’s more, traditional music is produced with the Kasha and exchanges are made with others not doing this. This is valid, it generates income, it is like strengthening what we belong [to] and [what] belongs to us.

Thus, the installation of this type of center requires a participatory process that, among other aspects, will determine the community’s communication strategy and the content that is required to meet its life plan.

**Recommended reading**


19 Taken from Asociación de Medios Indígenas de Colombia [http://www.amcic.info/?q=node/3](http://www.amcic.info/?q=node/3)

20 *Radio station Appraisals and/or Indigenous Radios: Columbian Communication Ministry* 2009 p.45

**3.5.3. Best practices**

In selecting programmes that represent best practices for this chapter, their contribution in the creation of an enabling environment for content development was taken into account. Even though the specific objective of the programme might not be the formulation of local content but rather the strengthening of Indigenous broadcasters, the way that programme was created and implemented incorporated all the
key elements needed for an enabling environment for content development. In addition, the design met other key elements with respect to regulations pointed out in this section.

The Indigenous Radio Stations Strengthening Plan (2008-2010) of Colombia’s Ministry of Information Technology and Communication derives from the Indigenous Broadcasters Appraisal carried out in 2008 in coordination with the Ministry of Culture and the National Indigenous Organization of Colombia (NIOC), which among others, identified the following issues:

- Stations’ lack of consistency with the plans of life of their communities.
- Lack of knowledge of, and support for, Indigenous councils and other traditional authorities.
- Weakness in the stations’ organizational and administrative structures.
- A lack of local radio production.
- Of 29 stations (26 stations and three Indigenous community broadcasters in Indigenous zones), 20 stations broadcast programs in their native language, three do not broadcast programs in their language, and five belong to communities without their own language.

Based on this analysis, a Strengthening Plan was agreed between the NIOC, the Ministry of Communications and the Ministry of Culture. In executing the plan, formative and self-formative processes were put into practice, utilizing the construction and adoption of an Indigenous radio format. The plan also called for regional broadcasters’ meetings, strengthening of the Indigenous radio network and formulating Indigenous broadcasting policy guidelines.21 In the same vein, the Mochila a la Palabra programme was produced, whereby samples of radio programs from 24 indigenous radio stations were collected. There was also radial training focused on the recovery of Indigenous peoples’ folk memories.

As can be observed, this programme incorporated many elements of the key content-generation aspects identified in this module. It arose from an appraisal developed jointly with Indigenous peoples, and it was linked in implementation with Indigenous peoples’ institutions. It strengthened the design of the content plan in accordance with community life plans. At the same time, it strengthened their production capacities through direct training, as well as through the exchange of experiences, and it provided a means to share and disseminate content while strengthening the scheduling of local media. These elements can be adapted to a program of content formation in access centers in many Indigenous communities.
It should be noted that various experiences indicate that content formation takes place primarily when the community access centers are associated with other local media, such as a radio or television station, or when there is a content strategy for the strengthening of the community’s presence outside its limits.22

21One of the networks is the Asociación de Medios de Comunicación Indígena de Colombia Red-AMIC, which works with 10 Indigenous radio stations in the Department of Cauca
http://www.amcic.info/?q=node/2


3.5.4. Self-Evaluation

<table>
<thead>
<tr>
<th>Creation of a content development policy framework</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A national plan for local content development exists</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The plan includes the whole cycle of local content development</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The plan contains actions for the creation of distribution markets</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The plan contains actions for training of communities in areas related to content production</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The plan contains measures to provide or facilitate the procurement of equipment for content production</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The plan contains actions to make the existing content available among Indigenous people or provides means for the exchange of local content</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The plan provides measures for the protection of traditional knowledge</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The implementation of community access centers anticipates the participatory formation of a plan?for content development</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
Participatory formation takes as an input or generates the life plan of the community or its development plan

The school in which the center is installed has as one of its objectives the use of the center for local content generation

3.6. Capacity-Building

The establishment and strengthening of capacities covers all areas that have been considered in earlier sections, from planning and operation of basic tools, maintenance and installation of networks and equipment, and development of applications, up to advanced research in applications, networks and regulation.

The table below illustrates the roles of various players in national policy and local communities.

<table>
<thead>
<tr>
<th>Capacity building area</th>
<th>Community Access centers</th>
<th>Service Providers</th>
<th>Applications</th>
<th>Research and development</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Policy Agent</td>
<td>???????? Local Service Provider</td>
<td>?????????</td>
<td>????????</td>
<td>Research Networks Institutions &amp; Universities Development Agencies Industry</td>
</tr>
<tr>
<td>Promotor</td>
<td>Software Developers</td>
<td>Training Institutions</td>
<td>????????? Other Media</td>
<td></td>
</tr>
<tr>
<td>Capacities</td>
<td>Participatory Planning &amp; Appraisal</td>
<td>Necessity Based Applications Identification</td>
<td>Capacity-Building in Application Management Application Development</td>
<td>Coordination with International Institutions</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----------------------------------</td>
<td>---------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
</tbody>
</table>

**Community**

<table>
<thead>
<tr>
<th>Agent</th>
<th>Community-Agent</th>
<th>Digital Center Networks</th>
<th>University Assistance</th>
<th>Other Organizations Community Center Committees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Committee</td>
<td>Community Groups</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Community Center</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>International Telecenter Networks</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>International &amp; National University Assistance</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>National &amp; International Movements</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
## 3.6.1 Key Elements of Capacity-Building

All of the key elements of capacity-building should be reflected by the people and organizations that execute connection plans in Indigenous regions. In other words, the task of governments is to develop institutional capacities and human resources to strengthen their communities. It is best to achieve this not through direct assistance, but through the strengthening of local resources and the provision of aid to networks that contribute to the development of community access centers.
3.6.1.1 Development of a Comprehensive Plan

Capacity-building cannot put to one side any single aspect of the chain of production and the development of ICTs. In this sense, an integrated development policy includes the capacities necessary for interaction with the community, deployment, supply and maintenance of the service, the development of applications and the development of equipment suitable for the context of this type of communication -- in addition to the policy and regulations that contribute to its provision. In the same way, these capacities, or the links to networks that they have and develop, must be present in the community.

Connectivity plans focus their efforts on creating capacities for the use of ICTs in communities but forget to create the minimum capacity necessary for the installation and maintenance of the network. This creates a huge external dependence and imposes high costs in problem solving that could otherwise be resolved in situ, such as the reconnection of an antenna or the installation of an antivirus program, among others.

3.6.1.2 Staff with Skills and Abilities for Intercultural Community Work

The most repeated problem with the installation of ICT access centers in Indigenous communities is that the people involved in strategy and implementation lack experience in community work. So they often propose programmes from the perspective of outsiders. The errors in building access centers often violate community social structures and come to create real conflicts that ensure the failure of the centers and affect the likelihood of successfully undertaking other collective projects.

The installation of a digital center within an Indigenous community is a political and social event, bringing along with it empowerment that must be appropriately managed, so that it benefits the community as a whole and not just one individual or group. Recent history is replete with many examples of access centers abandoned or destroyed, solely because they lacked a proper participatory process during installation and operation.
In this regard, it is indispensable to set a standard of competency in the training of those responsible for community planning at digital centers. The Philippines does this, representing a best practice for the sustainability of such centers.

3.6.1.3 Self-sustainability Guidance

Capacity-building refers to more than just training. It implies returning to the community its ability to be self-reliant. It involves a way of relating with the community that avoids dependence and strengthens both internal and external community collaboration. In practice, the difference between training-oriented activities and training geared toward the construction of capacities is vast. After a successful training workshop, the participants feel that they have learned. But after a workshop on capacity-building the participants feel they knew a lot, but now know a lot more, and that they are capable of dealing with situations they will confront because they will be able attain the necessary resources to do so.

Self-sustainability guidance above all relies on local human and material resources. It strengthens the relationships within the community and creates new external relationships. It allows the community to manage resources and increases the information and knowledge available.

Capacity-building ranges from the tangible to the intangible. No one single course can be defined as the correct path to capacity-building, because each situation is unique, but the following development can be articulated.

Capacity-building begins with the strengthening of community identity and aspirations. The community recognizes its world -- its myths, values, natural resources and the people themselves. From this point, the place the digital center will occupy in the community is defined. Community members continue by identifying their ideal situation (their dreams, some would say) and by charting a path to them. At this point, a plan now exists, and the community members know what training they require in order to attain their objectives. They can now start to explore their capacity to associate with others and to obtain the resources in order to acquire the skills they need to employ. The rest is a matter of training and resources, the visible and easiest part. The other key elements will clarify this aspect.
3.6.1.4 Always Start with the Organization of a Community Committee

Throughout this section, the various aspects related to participation at every development stage have been highlighted and there is no exception here. Aspects related to capacity-building do not simply come to fruition once the access center is installed, they have to be planned.

Prior to the access center's installation, it is necessary to work with the community to name a committee that will accompany the planning and construction process and that will, by preference, continue the technical assistance work of the center after its opening. The committee must:

• Be formed by people with the natural ability to use technology;
• Be heterogeneous in its age structure and include people with roots in the community and who are committed to it;
• Spread the word to people who can provide technical support to the network in the long term.
• Share responsibilities and obligations among members and, in addition, document procedures in an operations manual for support and guidance.
• Collaborate closely with a local organization that provides support and take its opinion into account with respect to the integration of the team.

Having a committee that participates in all stages of the process allows the community to have personnel that understand the functioning of the network and the center, because they have participated in its planning and construction. This furnishes a foundation on which other abilities can be built, and it also offers a point of reference for the service provider to seek help in diagnosis and repair in case of operational failure.

3.6.1.5 Start From a Participative Appraisal

Prior to commencing the operation of the access center, the community will need to review its development aspirations and find the place that the access center will occupy in reaching its objectives. In the appraisal, the different groups within the community must recognize the usefulness
of the digital center and define what objectives they hope it will help them meet. That way, training needs can be identified based on their real value.

It is important that participatory appraisals involve all sections of the community -- and above all the most vulnerable, including women, children, marginalized groups or individuals with disabilities. Every community presents a unique set of such groups and individuals. It is sometimes necessary to carry out specific activities for certain groups, such as women, so that they can feel more at ease working separately. It is important to integrate everyone’s vision into the access center plan.

The methodological tools with which to do this are varied and with multiple sources such as 80 Tools for Participatory Development: Geilfus F. (1980) [link](http://www.crid.or.cr/digitalizacion/pdf/spa/doc15788/doc15788-a.pdf).

Another specialized text for telecenters in Indigenous communities is the following manual for participatory workshops: ITC Use for Local Development: Community (Medellín 2006). [link](http://www.slideshare.net/diocesispopayan/manual-taller-participativo-telecentros-1)

### 3.6.1.6 Appraisal-Based Training

The appraisal is the basis for prioritizing training needs, but this does not mean that such needs are immutable. New requirements can emerge during the process, but they always must be weighted along with those identified initially.

Moreover, the appraisal provides the basis to measure the impact of the training and assess its results, since it relates to a specific development need. The training is useful only to the extent that the need is satisfied.

Given that we are talking about access centers located in schools in Indigenous communities, it is essential from the outset that the educational results the community will attain are defined, beyond just access to information or computing time for the pupils of the school. The ideal result is for the access center to become a space to create local educational content that contributes to intercultural education in these rural communities. [24]
3.6.1.7 Network Creation

The essential element for the continuous strengthening of community abilities is direct access to media and links that allow for the exchange of experiences, as well as relationship strengthening and technical advice. It is important for the appraisal to identify groups and institutions near the community that can support the capacity-strengthening process and those national or international networks with which the community can be linked.

The generation of national or international encounters for the exchange of experiences is also a good practice with which to strengthen local initiatives.

With respect to this, there are international networks such as the Network Somos@Telecentres http://www.tele-centros.org/paginas/inicio.php and Telecenters.org, http://telecentre-comunidad.ning.com/ operating as a virtual space for the exchange of experiences, training and technical support.

3.6.1.8 Preparation to Meet Local Training Plans

It is often thought that capacity-building plans and programmes can be developed into a single structure, or in other words, one unifying programme that can be adopted by every access center. This would take the form of a single curriculum that each access center manager or operator would comply with. In a programme aimed at local capacity-building, however, local training plans will be community-specific, and the organizational structures, the access centers and national structures for capacity-building must be able to respond to local variations.

To achieve this requires linking communities to institutions and training tools, as well as the availability of online content in appropriate indigenous languages and in diverse themes. At the same time, there must be local networks that allow easy access to training based on community needs. The table presented earlier in this section indicates a scale of networks for capacity-building.
Recommended Reading

The recommended bibliography below covers three fundamental aspects of the formation of an appropriate capacity-building program. The first presents an example of national competencies for managers of access centers. The second contains practical information for training in the development of local networks. Chapters 9 and 10 demonstrate important guidance for the formation of community technical committees and the organization of community centers. There is a useful handbook for the organization of access centers, based on a participatory model that, in turn, is based on a needs appraisal that allows for the conclusion of a training plan. Finally, the third publication serves as the source for the section on best practices of this text.


3.6.2 Best Practices

The exemplar for best practices in this section illustrates all the factors inherent in capacity-building that have been cited in this part of the toolkit. This programme began before the popularization of the Internet, but it continues to be an essential point of reference in the field of Indigenous communication.

The Guarani Communication Unit required an ample development process. Its story began with the Evaluation of the Province of the Cordillera de Santa Cruz, Bolivia in 1986, which encompassed several Guarani communities. In this evaluation, the Guarani People's Assembly (APG) adopted a number of development strategies, via dissemination among the various Indigenous leaders. The APG
formed an organizational structure, whose projects and programmes were implemented through coordination with public institutions, international agencies and social organizations.

Education was identified by the APG as fundamental for development of an intercultural and bilingual proposal to improve Guarani education and acquire appropriately honed human resources, consistent with their origins and committed to their community. Under this strategy, and with the aim of having a mechanism for the execution and implementation of programs and projects, the Workshop of Education and Communication Guarani (TEKO Guarani) was constituted and began work in coordination with state and international institutions such as UNICEF.

As part of TEKO Guarani, a communication team was instituted, which supported literacy and bilingual education activities through content produced locally and supported by local radio stations that were even able reach other Guarani communities in Paraguay and Argentina.

After very successful work, in 1995 the TEKO Guarani and the FAO Communication for Development in Latin America project signed an agreement that would transform the TEKO Communication Team into the Guarani Communication Unit (UCG). The goal was to generate a communication system that would improve the quality of life of the Guarani people and promote Indigenous development. Three years of planning workshops and training went into building a Guarani people’s communication vision. With technical support and international financing cooperation, an intercultural knowledge and information-sharing proposal using video and community radio was defined. The communities continued working independently, producing communications materials and implementing plans aimed at development for another six years.

Motivated by its prior performance, the UCG decided to conduct a self-appraisal of its work. For this reason, help was sought from the APG and other indigenous organizations in Bolivia. For the first time, the Indigenous population independently documented and systematically analyzed the use of the media and communications produced by and for Guarani communities. The results of the self-appraisal confirmed the importance of adopting new media. New goals were defined, such as the need for a national policy that recognizes the right of the Indigenous people to provide and access communication services with funding from local institutions.

Currently, the Guarani Communications Unit continues to promote audiovisual courses in communities, with a pedagogical method developed by the unit’s members themselves that is participatory and focused on the search for solutions to the communities’ needs. Additionally, the unit formulates and
implements peasant training communication plans that allow them to agree on the priorities, technical information, resources and logistics. They produce materials collectively and optimize the resources available. These plans have also been useful as negotiating tools for projects by local municipalities.

As can be seen, this best practice example began with a planning process that was founded on the community life strategy and adopted communication as a tool with which to support the various development activities considered fundamental. Its progress, then, not only extended to applications and content generation, but also to research and involvement in public policy formation, in order to monitor results. In this example, capacity-building is evident in all aspects.

### 3.6.3 Self-Evaluation

<table>
<thead>
<tr>
<th>Generation of an enabling environment for capacity-building.</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A national capacity-building plan exists</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The plan includes actors and institutions involved in access centers, local service provision, applications, and research and development.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The plan seeks to strengthen capacities for the areas mentioned both at national and community levels.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Personnel in direct contact with the communities are trained in participatory methods of community development.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Community level training activities are based on an appraisal exercise or community plan.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>A committee is formed by participants during community consultations regarding access center implementation.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Groups, organizations or small businesses exist at a local level that can provide maintenance services to the network and the access center.</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
The local network is connected to other institutions or groups that allow for the strengthening of access center and community level capacities.

Connections to international tele-center networks are fostered and facilitated.

National level installations exist for the exchange of community experiences.

The impact of the programmes, courses and workshops are evaluated against the impact of capacities necessary to achieve the communities' development objectives.

### 3.7 Participation

During all the topics covered in this chapter, it has been highlighted that participation is an essential element in all the phases that constitute the generation of an enabling environment for community access centers located in schools. Participation also is needed in all aspects of planning, installation and operational processes. We can say that participation is the axis that links all areas and environments with respect to access centers.²⁵

This section contains the central aspect of all the work related to the installation of access centers in Indigenous communities and other remote communities. It also synthesizes participation in every phase of the process of installation and operation of access centers, all of which are aimed at achieving technological adoption in the community.

When participation at the community level is spoken about here, it refers to something that goes beyond the simple fact that the community is taken into account in the decision-making process. We refer to community adoption of ICT -- that is, the incorporation of such technologies into the life of the community. So the new facility cannot be understood as solely an access center, but as a tool, or a strategy at the service of the community's life plan.

“Social Adoption means that the resources of the Internet have helped to solve specific problems with respect to the transformation of the community's reality. The evidence of
adoption is not in the use of the ICT, but the changes that have occurred in the real world. Only when the resources of the Internet are useful tools with which to transform their reality and ITCs reveal their potential to contribute to development... The challenge is to go beyond connectivity, which by itself is insufficient, and include the dimension of equitable access, use with-sagacity and social appropriation of ICTs for development.

As such, programmes and projects that incorporate ICTs in Indigenous communities should promote and facilitate the adoption process, which is accomplished by encouraging community involvement in all phases of the process, strengthening local capacities and considering the specific contexts in which ICTs are inserted.

The principle ideas in this section are taken from an unpublished study carried out in 2006 under the supervision of Sofía Medellín y Diana Marenco entitled: Considerations about the Community of ITCs and Telecenters.


### 3.7.1 Key elements

There are five key elements of participation. In defining these key elements, only a brief explanation will be given, since the theme of self-evaluation and community input has been explored exhaustively in defining the questionnaire that guides every aspect of participation and is presented here in a general form.

#### 3.7.1.1 Community Participation in the whole process

Perhaps the most important element -- recognized with increasing frequency as a requirement for telecenter adoption and sustainability -- is community participation in all stages and activities of the project. Speaking of participation, however, can prove a little ambiguous; in any project there exists different levels of beneficiary participation, ranging from the simple acceptance of projects, consultation, shared decision-making, and collaboration, up to the self-management of projects.
It is known that higher levels of community participation contribute greatly to achieving the project's adoption and long-term sustainability. The extent to which the community participates, from their own forms of organization, and defines the most substantive aspects of the project, it will adapt to local conditions. People will involve themselves and make the project their own, contributing significantly to the sustainability of the project.

3.7.1.2 Complete Autonomy in the Decision-Making Process

Although decision-making has already been referred to as a possible element of participation, it is important to emphasize this when referring to the acceptance of a project. It is essential that the community be able to make decisions that define the access center's direction and characteristics, including planning, design, operation, resource administration, monitoring and evaluation. In this, it can be ensured that the access center is going to respond to a specific reality and context -- to the needs of the community -- and will adapt to the necessary changes when required.

In addition to encouraging the community to make decisions about its own access center, co-responsibility of those involved in the project is recommended. This must begin with the fundamental decision of whether to introduce the project into the community or not. Information is a key ingredient in the decision-making process, and the community should have full access to it. By the same token, reflection on the decisions taken should be promoted. It is important that, within the community, there is clarity about the potential impacts of such projects -- both positive and negative -- and that the community can generate its own strategies for dealing with them.

This point is particularly relevant with respect to connecting schools. Connecting a school does not necessarily imply taking it to a community, as indicated in the Module 1 part 4 of Connect a School - Connect a Community. The expansion of Internet service to the community can occur in two ways: (1) the creation of community access centers within schools, or (2) the use of access centers as nodes for the deployment of connectivity to other areas of the community or to other communities.

The creation of such centers at schools, or the use of them as development nodes, requires the definition of protocols that allow a joint administration of the operational space. Many access centers
installed in schools designed to provide a service to the community never do so, precisely because during their planning and implementation there was no plan as to how they would accomplish that task.

Schools are spaces normally closed to the community, for obvious reasons of securing the facilities and student safety. Thus, they are not wholly public spaces, and that is why the process of making decisions with regard to the manner in which the school will provide connectivity to the community is impossible to ignore.

3.7.1.3 Participation in Capacity-Building

Since this issue has been abundantly addressed in other paragraphs it will not be dwelt upon at this juncture. Nonetheless, community participation in three aspects of capacity-building is essential:

- The selection of training areas in accordance with the community life plan
- The formation of groups or committees that will be empowered in order to tend to tasks related to access centers
- Participation in the strengthening of capacities of other communities and individuals.

The points raised in the preceding paragraph enable us to ensure there is training that is significant for the community and that it occurs in areas where there is real application of work to improve peoples’ quality of life. Secondly, it is important to have groups available that are able to tend to access centers’ minimum technological requirements. Finally, the third element facilitates the creation of capacity-building networks and the development of training content in the communities’ own languages.

3.7.1.4 Participation with Resources and Capacities

In the process of adoption, and to contribute to the sustainability of the tele-centers, it is recommended that, as much as possible, local resources and capacities be incorporated into the project. Provided it is carried out in a context of real participation and co-responsibility, community input is very important to reinforce the process of project adoption, which along with local capacity-building reduces dependence on outside support.
To achieve this, it is necessary to identify human resources, materials and institutional backing in the planning processes. These resources can be used in the installation and operation of the center and, of course, are usually defined by the community itself.

3.7.1.5 Cultural Relevance

As has been mentioned, each ICT project is introduced in a particular context that must be taken into account from the moment the project is proposed. Cultural relevance of the project can only be achieved with the participation of the communities where it is inserted. The communities themselves must define the nature and the nuances that the access center is to have, along with the use that it is given, in order to adapt it to the relevant cultural context.

_To defend our Life Plans, we have gone from the oral tradition to the modern media, without forgetting our principles as Peoples. We take advantage of the new technologies in communication to make ourselves visible and to empower our own media. This strategy stems from the need to make visible and publicize the importance of our culture and at the same time denounce the many abuses suffered by indigenous people of Cauca in every sense of the word._ Indigenous National Council of Cauca [http://www.cric-colombia.org](http://www.cric-colombia.org)

In this sense, it is of the utmost importance that the community’s social structures, decision-making bodies and life plans are respected. On one occasion, a group of researchers working at an access center located at an Indigenous school agreed to produce an Internet portal about the Wixarica people in Mexico. They formed a group composed mainly of Maracames (traditional doctors) from the community. When the portal was completed it was submitted to the community assembly, which banned the portal because the project had never been approved by the community and the group had not been authorized to divulge information about its customs and rituals.

Indigenous communities have decision-making and information handling protocols. Knowing and following these are the first steps towards implementing a successful project.

Further Reading
The recommended literature shows us a program for the development of access centers based on a participatory model and a tele-center community adoption methodology.

• *Toolkit for Setting up Rural Knowledge Telecentres*; M S Swaminathan Research Foundation


### 3.7.2 Best Practice

The best practice found with respect to this topic could undoubtedly also fit several other aspects of this module. Here we refer to Mission 2007 of Grameen Gyaan Abhiyan in India http://www.mission2007.in/.

The Grameen Gyaan Abhiyan is a rural social knowledge movement that seeks to empower 637,000 villages through a team of multiple actors. It is based on different ICT development models in India, including community access, entrepreneurship, government, business, cooperative action and various combinations of those models.

This movement was selected as an example of a best practice that stems from the guiding principles on which it is based:

- It is a program that focuses on people and is based on community adoption. Therefore, its operation requires the support of the community as a whole.
- It takes into account local context and the information needs of the people, therefore providing useful services based on demand. Although various types of technology are used and researched, the program does not seek to demonstrate the power of technology. Its usefulness is more important than using the latest technology.
- The program seeks to be inclusive and allows for everybody’s participation. Therefore, principles such as social inclusion, gender equity, attention to remote areas and regional inequality solutions are the basis on which to build community centers.
In this program, access centers are operated by community groups that define which of their needs and the objectives can be attained by the use of technology. The access centers are linked with multiple institutions in order to access information and capacity-building.

Participation and, therefore, community access center adoption, is the backbone of this process, along with collaboration and networking, which can be identified as a best practice.

3.7.3 Self-evaluation

As mentioned at the beginning of this section, the self-evaluation elements of participation will be more extensive, and unlike those in other sections, there will be one table for each area of participation.

<table>
<thead>
<tr>
<th>Participation in the Planning. Who plans?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>The community is consulted.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The community can decide whether to carry out the project or not.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The project involves members of the community who have the endorsement of the community.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The structures and forms of community organization are considered.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>It is a result of a local initiative.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>It stems from a need for information and community communication identified by the community.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The planning is carried to the interior of the community.</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participation in the Planning. How to plan?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of the local context is obtained from a participatory appraisal.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The community takes decisions in the planning of the project.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The planning process tries to strengthen local capacities.</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
### Participation in the Planning. What aspects are planned with the community?

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Capacity-building.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Needs for information and content production.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Administration and operation of the access center and of the services it will provide.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Assessment is planned with the community</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

### Participation in the operation of the Access Center

<table>
<thead>
<tr>
<th>Participation in the operation of the Access Center</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>The members of the community are involved in the administration of the center.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The members of the community participate in the operation of the center.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The members of the community are involved in monitoring, maintenance and failure reporting.</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The members of the community that involve themselves in these aspects have?community support.</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

### Participation in the use of the Access Center

| Uses are defined by the community according to a participatory appraisal. | ?   | ?  |
| All sectors of the community, in particular the most vulnerable ones, are considered and participate in the definition of uses. | ?   | ?  |

### Participation in Sustainability

| The community defines the sustainability strategies. | ?   | ?  |
| Members of the community are involved in various aspects of the operation of the access center. | ?   | ?  |
| The community contributes directly, in cash or in kind, to the sustainability of the access center. | ?   | ?  |
| There is a long-term sustainability plan. | ?   | ?  |
| The community or its delegates participate directly in networks that contribute to its sustainability. | ?   | ?  |
| Local resources are used when possible. | ?   | ?  |

### Participation in the Evaluation

<table>
<thead>
<tr>
<th>Participation in the Evaluation</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>
The community evaluates.  
The community defines indicators.  
The community is the main target group of the evaluation.  
The community can make decisions with regard to the access center, as a result of previous evaluation.

<table>
<thead>
<tr>
<th>Participation in the Strengthening of Capabilities</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>The community defines its training needs from an appraisal</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The community participates in training networks</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The community produces its own training tools</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The community produces educational content</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cultural Adoption of the project</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>The community integrates the project into its life plan</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The project respects the social structures and values of the community</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>The project can be adapted to cultural characteristics</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

4. What is the Role of Indigenous Peoples in the Installation and Operation of Access Centres Located in Schools in their Communities?

Just as the government of each country must carry out certain actions to ensure the development of the ICTs in Indigenous communities, the communities themselves have at their disposal several actions for ensuring that ICT projects placed in their communities are sustainable and contribute to their development.

Although the national strategies for developing ICTs in Indigenous communities are a very important contribution, the role of the communities themselves is essential. There are many examples across the world where communities have managed to establish sustainable projects in spite of political indifference towards the development of ICTs. Through networking and organization, grass-roots projects have often managed to transform national politics.
This chapter will talk about the basic steps that an Indigenous community, or a community located in an isolated region, can carry out in order to achieve the conditions for sustainability of an ICT project and the use of ICTs for development.

The path winds from local to global, and it passes through the basic steps of every community project. Yet this time it is focused on ICTs, specifically in access centres located in schools, or connectivity in schools for deployment in the community.

The importance of Indigenous community participation is covered elsewhere in this module. This section traces the path to be followed by a community that wants to ensure a successful process of community adoption of ICTs and wants to contribute to the creation of an enabling environment of ICTs for Indigenous peoples at a national level.

According to the way in which we have designed it, this path has the following stages:

1. **Discovering**: The project has to find its place in the core of the community life plan. This stage is the equivalent to the birth of the soul of the project; it is what will keep it alive in the life space of the community.
2. **Organizing**: The project needs to find the people and the community spaces that will help it to develop. This stage is similar to the birth of the body of the project -- it arms and legs, with which it will be able to start moving.
3. **Defining**: The project must be clearly defined and based on a plan of execution. To continue with the analogy, this stage is the creation of the mind of the project.
4. **Connecting**: In this stage, the project has to find other, similar projects that it can align itself with. The best way is to start by looking for the closest ones and then to join forces with them. During this stage, the project is already complete -- it has a soul, a body and a mind -- but one can never be a full person without friends, thus this is the right moment to look for them and become part of a new group.
5. **Networking**: The project organizers will notice that there are many more projects like it, sharing a lot in common, and that together they can achieve the changes they are looking for. At this point, the project embarks on a journey to know the world. It is connected to the ground where it was born and it participates with other projects in activities that generate common benefits for all those who are like it.
6. **Telling and reflecting about its story**: The project has a full existence. It is now growing, and it needs to see the path it is taking and the way it is growing.
As with any other path, the road to a successful ICT project is one that can be started at different points. Sometimes we start in the middle, and this is fine, as long as we pass through all the stages. Experience shows us that the boundaries between the stages change all the time and that some stages may even take place simultaneously.

We will follow the path as we have described it here. We will do it using case studies of processes followed by Indigenous communities, and, last but not least, we will provide a couple of questions that can help verify if any given community is following such steps in its own process.

4.1 Discovering

It is common for Indigenous peoples to reflect about life and to comprehend the role that their community has in it. It is through songs, tales and stories, knitting, crafts, legends, dances, and rituals that the new members get to know about the history of the community, so they can think about it and understand their reality.

All these activities, as well as the assemblies, the tequios, the mingas, are the processes on which the community builds, remembers and updates its life plan.

“From our perspective, we build communication from our own ways. There are many sorts of ways of communicating, such as knitting - that is communication - the mingas- that is communication - and through many other of our communication experiences.”

Therefore, the access center is a new instrument for communicating such a life plan and for helping these ways of communicating to achieve their objective. Thus, the decision to start a communication project, in this case a communication center in a school, cannot be unconnected from the life plan of the community, since it is within this plan that the project justifies its existence and finds its objectives.

“In order to defend our Life Plans, we have gone from oral tradition to communication media, not forgetting our principles as peoples. We take advantage of the new communication technologies for making ourselves visible, empowering our own communication means. This strategy comes from the need for noticing and communicating the importance of our culture
and, at the same time, condemning in all manners the abuses committed against the Indigenous Peoples of Cauca.”

Gathering in an assembly, a minga or any community event is an essential step that cannot be omitted in the process of determining why to create an access center and what role it will play in the community.

27 Translator’s Note: A tequio is an organized way of working in which the members of the community must contribute with materials or manpower in order to build a communal building.

28 Translator’s Note: A minga is a traditional form of communal or social work with social objectives, which can also be performed for the benefit of one person or family, and in which there is always a benefit for the participants. It is mainly practiced in Peru, Ecuador, Bolivia and Chile.


4.1.1 Case Study (Regional Indigenous Council of Cauca)

The Nasa people are located in the Cauca region in Colombia. [30] They consider the practice of their life plan as a right. The concepts of unity, culture and autonomy are articulated in the plan for the benefit of the members of the Nasa people and their environment.

“We have clarified that we also have a political choice in this world, that we also think, that we also have a philosophy […] This right is so real that, even though they have not wanted to accept it, they have not been able to ignore it either. Our territory, our resources and the possibility of managing our own development according to our way of thinking, and not according to the values of a system that they want to impose on us, are a fundamental part of the rights for which we keep fighting.”

Keeping this in mind and very present in their life plan, the Nasa, with the aid of the Regional Indigenous Council of Cauca, started to write down its life plan at a time when the government also started to demand development plans for the region. When making their life plan, the Nasa kept in
mind the perspective of women on how the plan should be created in order for it to be inclusive and harmonious. They used the analogy of knitting:

- “The beautiful and harmonious unity of the many stitches integrating the final product of the knitting.”
- The balanced encounter among colours, figures and different stitches as a whole.
- The result: the knitting as the product of different proposals, objectives and ways of working and methodologies. Different, yet oriented towards the same goal.
- Knitting with different ends and uses according to particular communitarian needs.

All the areas that must be assessed were pointed out inside this plan, among which were education, language and communication:

- That the language recovers itself in all its spheres: comprehension, speaking, writing. It must be promoted at a local and a regional level and used in the communication and expression of media, in which young as well as elder people participate.
- To confirm the educational project corresponding to the Indigenous cabildos\(^{32}\) of Cauca. To unify an education proposal that allows projecting and coordinating activities among the different councils and their educational institutions.
- To create our own communication strategies, taking advantage of the technology and the professional capacities of some Indigenous people. Some communication means have been implemented that respond to our language, uses and customs. The Indigenous radio, websites, newspapers, magazines and audiovisual materials are particular cases. The objective is to find exposure through means of communication controlled by indigenous peoples.

In order to address such issues, one of the actions taken by the Nasa people was to create the Communication Program of the Regional Indigenous Council of Cauca, which pointed out the following principles for the media that will belong to this program:

- Informing: To have the capacity to focus the attention of the community on the activities that the national, regional and local organisations and the different social sectors perform on matters of social interest in which they are involved, contributing with elements for analysis which promote and facilitate people’s comprehension of their reality and create a public opinion.
• *Educating:* To develop a direct and bilateral communication, optimizing the broadcasting and reception capacity of the indigenous peoples in Cauca. We want to enable the knowledge and analysis of the reasons which lead to the existence of this social reality, to create conciliation spaces, to facilitate bringing out and putting in common different points of view.

• *Mobilizing:* To create awareness about the social reality of Indigenous peoples of Cauca, having an effect that makes Indigenous people and social actors move towards the execution of ideas, proposals and projects for achieving a peaceful coexistence, to recover trust and strength culturally, socially, politically and organizationally.

This is the story about the way in which the Nasa inhabitants designed their communication project. The objectives and the role that the media plays in the community are well traced, the corresponding ideas are clear, and there is a commitment from all of the members of the community to undertake them. We could say that the Nasa successfully covered the first stage of the path.

30 All of the notes that we mention in this chapter are mainly taken from Otero, José. *El derecho a la comunicación en el Plan de Vida de los Pueblos Indígenas del Cauca.* Colombia. 2008.


32 Translator’s Note: A *cabildo* is the equivalent to a town hall or council.

### 4.1.2 Are we heading in the right direction?

If you are starting a project to connect a school in your community, or if you have already started one, it would be good to apply the following questions in order to know if you have successfully covered all the required steps.

- Was the project discussed in the assembly?
- Is the life or the development plan of the community clear?
- Is the role and function of the project in the life plan of the community clear?
- Is it clear what other areas of the life plan the project is related to?
Could it be said that the role of the project in the life plan of the community has been found?

4.2 Organizing

We know very well that no matter how good an idea for a project is, it cannot be done alone. There must always be someone who develops it, someone who takes specific responsibilities. In other words, we need to appoint the people who will be coordinating the project. The communities know very well how to choose such people. They know their talents and they also know their defects. The community leaders know how to create a balanced committee integrated with all of the people who should and who want to be there.

The following elements should be taken into account when selecting the committee that will be in charge of the connectivity project:

a) Continuity: The project will take some time for installation and development, so it is better to have people with roots in the community, who will not leave any time soon.

b) Ability: Within the community, one can find people who have previous experience with ICTs or who can understand the subject more easily, such as children and young people.

c) Inclusion: It is important that those who are in an area related to the project participate in the committee so that everyone’s vision is included and the project can be more easily implemented. The presence of women in the committee is also important, since they will be an important part of the users and managers and they generally have specific activities and projects in the community.

d) Alternation: Many communities have found alternation to be an excellent way of avoiding the concentration of knowledge and experience in just a few people. After a certain period, people switch roles, so that others can learn their skills. As a result, the operation of the project is never at risk because of the absence of one of the members of the committee.

Generally, the committees are created in an assembly so that the elected persons respond to such authority.
Once the people have been chosen, they need a place to work. At this point it is necessary to establish (though it can be changed later on) one or more places where the project is going to be installed. It is convenient to have several options since, throughout the project, the characteristics that the place should have will be revealed. Sometimes the signal is better in some places than in others, or the people have an easier access to one place than to others. These are important factors to consider in locating the access center.

It is very important that all of the agreements mentioned above, and those that continue to be created along the way, are formalized in writing, so that they are available when they need to be reviewed.

4.2.1 Best practice

In Mexico, there is a community called La Mixtequita, composed of Mixtec Indigenous people who were relocated there. A community access center was installed there in a school. Unfortunately, the center saw no use, because the director of the school was afraid that the computers would break down.

Encouraged by a promoter, representatives of the community gathered in the school to discuss the access center. The community members included farmers, a representative from the stockbreeders association, a group of women, youth from the public high school, children, the principal of the primary school, and the school committee, among others.

At the beginning of the discussion, the director pointed out why she had not allowed the use of the access center: “We are too few to manage the center, the equipment is very expensive and there is no one who knows how to operate it, so we are afraid that they will break it and there is no computer teacher.”

The others agreed with the director, but they also noted that in the community they had a high school in technology, which actually taught computer sciences. The only problem was that the high school did not have access to the Internet. Thus, the community decided to appoint a committee, composed of the members of the committee of the school, the high school students and representatives of other groups who would be in charge of labours at the digital center. Immediately after they were appointed, they started their training and the center started to run.
In this example, the installation of the center happened without even having a committee to run it. The connectivity had been installed in the school, when maybe another place would have been better suited for it.

As mentioned at the beginning, all the steps in the process must always be taken. Otherwise, at some point the project will have to go back to them. If La Mixtequita had had a planning process in which the community appointed the committee and determined the best place for the location of the access center, they might have avoided keeping the center closed for a year.

4.2.2 Are we heading in the right direction?

These are some of the questions that you can ask yourself to verify if you have correctly selected the committee for the installation and operation of the access center.

- Is there a committee for the connectivity installation?
- Is the committee composed of people with roots in the community?
- Are there women in the committee?
- Are there youngsters, children or people involved who have the ability to work with ICTs?
- Is there a scheme in place for alternating the roles of the people in the committee or for including new members?
- Are the agreements in writing?
- Are there options for places where the connectivity or the access center can be installed?

4.3 Defining

The project already has staked out the objectives to be achieved, it has a committee that will be in charge of turning the project into a reality, yet there are many things that are not clear yet, such as:

- **Infrastructure and sustainability issues** -- How is the center going to be operated, how much does the equipment cost, what has to be done first and which are the required activities?
• **Issues about the tasks and services that the center should provide** -- What are the ways or means of communication that can be reinforced with the access center, and what current community projects can the access center support?

To answer these and other questions that clearly define our project, it is necessary to address the following:

a) **What are the alternatives?** We know that we want an access center, but maybe we have never seen one -- or maybe we have, but we do not know how it works. Hence, in this first stage it is good to identify other experiences from communities who already have a center, to visit them and to ask questions such as: How do you connect to the network? Who is providing you the service? What are the requirements? How did you finance it? Where is the antenna installed and to how many people can it provide service? How much does it cost? Does it require particular care and maintenance? What are you using it for? Who supported you? Who trained you? And any other question that comes to your mind.

b) **What do we have and what are we missing?** With the knowledge of previous experience, we will be able to have a clear idea of what we need for our project. We will be able to order these needs in groups so it is easier to address and identify them. One possible classification could be the following:

- **Connectivity Needs:** All those related to the communication service, such as supplier or type of connectivity (Wi-Fi, Wi-Max, Satellite, Telephone, etc.)
- **Equipment Needs:** All those related to the equipment in the access center, such as computers, printers, cameras and all the other equipment required, depending on the use assigned to the access centre.
- **Training Needs:** All those related to the training that allows us to operate all of the aspects of the access center. Maybe not all of them can be attended to right away, but it is important that we keep them in mind so that little by little, we advance towards self-sustainability.

c) **What are the available media in the community and how will the access center reinforce them?** At this point it is necessary to identify the communication media that already exist in the community (radio stations, local newspapers, posters). Organizers can consider how the access center could contribute to their enhancement, or in the case of telephony, how it could make
telephone calls cheaper. For example, the center can contribute by establishing the radio station online, uploading the local newspaper, designing posters, etc.

d) What are the projects or services taking place in the community and how can the access center support them? In other words, what are the information and communication needs of each of these projects and how can the access center address them. For example, there could be tele-consultation in the medical unit, creation of education courses in the school, investigation of market prices of the goods produced in the community, etc.

e) What training needs does the community have? Items c) and d) provide relevant information for defining the areas that need strengthened capacities. As previously highlighted, one must identify all the required abilities so that the center can become self-sustainable.

f) How will the centre be managed in order to be self-sustainable? Keep in mind what will be the operational costs of the center once it has been installed, how they will be covered and where the ongoing resources necessary for sustainability will be obtained.

g) Who can support the center? In order to perform all these tasks regularly, the center’s operators will need external support, which might be technical, financial or training-related. The first place to look is at home, within the community itself. Perhaps the community can create a savings fund or give in-kind contributions. For example, many of the telecommunications cooperatives in Argentina were born in this way. Later on, organizers must look for the relationships linking the community to others in the area so that they are easily connected. Last but not least, organizers must identify the national and international networks or agencies that can support the center.

The plan is ready. Now it is time to take the first steps towards its fulfilment.

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4.3.1 Best practice (The Guarani Communication Unit)

The story we are about to present goes beyond the planning of the initial requirements of an access center. It speaks to the establishment of communications strategies that can be executed through an access center or other means of communication in the community.
The Guarani Communication Unit in Bolivia had in place a capacity-building process that allowed it to undertake communication plans and to use audiovisual teaching. Right from the beginning, the functions were mainly focused on a capability-training model.

With these tools, the Guarani Communication Unit identified the information and communication needs through a participatory process with the communities and groups. The methodology followed for this project identified traditional and local communication networks, linking points between them and the official technical services, and the needs for knowledge and training.

This diagnostic scheme allowed the detection of losses of traditional medicine knowledge in four communities. So traditional medicine men, community authorities and members of the community got involved in improving knowledge exchange and strengthening community control of the subject. On the other hand, among the issues that were identified by the community as a priority in its agricultural plans were activities for the production of materials and training courses.

As we can observe, the participatory appraisal process followed by the Guarani Communication Unit produced communication strategies to address specific needs, which were to be executed by the Unit but also by the members of the community and other stakeholders.

We chose an experience that focused on the establishment of communication strategies, since it is the base that will allow us to plan many of the elements required by our access center. For example, if the community has a radio station and wants to find audio content on the Internet, or to post a “podcast” on the Internet, the equipment, the connectivity and the capability training will be focused on those areas.

\(^{33}\) The example was taken from *Yasarekomo. Una experiencia de Comunicación Indígena en Bolivia.*

### 4.3.2 Are we heading in the right direction?

- Were there visits to other access centers or communication projects before the planning or was there a review of any material related to such topics?
- Do organizers have a basic idea of the ICTs and their possible uses?
- Is there a plan in which all the groups of the community had inputs in drafting?
• Do organizers have a clear idea about the communication means existing in the community and what its communication needs are?
• Is there an idea about the technical and material requirements for the operation of the access center?
• Is there a clear idea about the operation costs of the center?
• Is there a clear idea of the actions to be taken for its sustainability?
• Has anyone composed a list of the institutions and individuals that will be asked to support the different areas identified during the planning?
• Is there a committee responsible for implementing the plan, as well as timetables and actions identified for each task?

4.4 Connecting

At this point, the project already has a plan. It has defined its needs and has established its priorities. There is a list of the people who can help to attain those requirements, and a list of what kind of aid is needed.

The best approach is to start with the simplest issue and with the resources at hand. Maybe there is another community or a school or a university nearby that can help with technical matters. Maybe there is a government program, or maybe there are groups of migrants who are interested in helping or providing guidance.

When beginning to look for help, many possibilities may arise for working with another organization or institution. The advantage of having a plan is that it dictates what things are acceptable and what things are not. Without a working plan, many communities tend to accept projects as they come, without considering whether they might bring problems rather than benefits. The community may be forced to dedicate time and effort to something that it may not need or is not in its interest.

Another important issue when asking for support is never to allow the people providing it to perform the activities in place of the community or the committee. If the aid means undertaking a task, it is necessary to do it together in order to acquire experience and independence. For example, if someone provides connectivity, the community will work with them in installing the service but should insist that this kind of support include training.
It is very important for the community to have the power to decide in all matters related to the access center. So it is necessary to stay involved in its operation and to have well-trained personnel and committee members.

4.4.1 Best practice (The School Shelter of Chemax)

In Chemax, Yucatán, Mexico, there is an Indigenous shelter with a radio station operated by children from the shelter. They have a new digital center and the directors of the shelter are worried because they think that the computers and the Internet are yet another administrative problem. “Who is going to train us?” they ask. “Who will maintain those things?”

The shelter decided to undertake participatory planning about the access center that had been installed. In this exercise, many uses of the Internet were identified -- mainly those related to the supply of programming content for the radio and for climate monitoring of hurricanes, which are frequent in that area.

During the planning, there was also an evident need for a website for the radio station. Discussion centered on the question of who could train the local residents to build and maintain the website. The facilitator of the meeting asked, “Don’t you know anyone who can help you? A university? A technological institute?” The director of the radio station in the area responded that, in fact, he knew people in a technological institute nearby. A few months later, the radio station had its own website, designed by the institute, which also provided the server. The result is this website: http://www.cdi.gob.mx/mayadigital/chemax.html

The shelter knew how to take advantage of the relationships that it had identified at a local and institutional level to achieve its objectives.

4.4.2 Are we heading in the right direction?

• Have the partners, institutions and organizations been identified that can provide help?
• Is there a clear idea of the kind of aid that is needed and what kind of support is not acceptable?
• Is the aid received strengthening capacities or is it making the center dependent?
• What power for decision-making does the community have over the project?

4.5 Networking

All around the world, many Indigenous communities are working on access centers or other means of communication. They have problems in common, and they have multiple ideas and experiences for solving them. Many of them are part of networks that share information. Similarly, there are national networks that share and spread information through an organized work programme, and they also want to have an effect on the creation of a national policy favouring the development of Indigenous communication.

Network participation is the broadest stage in the development of an access center, since it connects a local community with its country or with the world. But network participation is useful only while it benefits the community; global issues make sense when they are related to local ones.

The construction of networks happens at all levels. It is necessary to start at the community, in the social network composed of the users of the access center. Those users will realize that they belong to many networks. When possible, organizers should contact the other access centers in their area, but even more important is to contact the communication centers that can broaden the scope of their communication work. Identify what is being done at a national level, both in relation to schools, and to access centers and tele-centers, and look for an international network. There are many national and regional networks, and at least one global one, to belong to. Above all, identify other Indigenous communities inside these networks.

Europe: http://www.telecentre-europe.org/
Asia: http://www.a-ptnetwork.ning.com/
Southern Africa: http://www.satnetwork.org/
America and the Caribbean: http://www.tele-centros.org
Worldwide: http://www.telecentre.org
Apart from networks in digital centers, Indigenous peoples have established a worldwide movement on Indigenous communication, into which they incorporate the access centers in different ways. This mainly involves applications and content that complete the work of other media such as radio, and in performing communication activities related to the recognition of Indigenous rights. For that reason, the networks of access centers in Indigenous communities cannot be limited only to participation in networks of tele-centres. Their place is also in the Indigenous media movement and in the movement for recognition of the rights of Indigenous peoples worldwide.

4.5.1 Best practice (Asodigua Telecenter)

The Asodigua Telecentre is located in Sololá, Guatemala, a rural municipality with Cachiquel, Quiche and Tzutuhil people. The tele-center is a major presence in the area. It trains many Indigenous communities, and has projects that support craftswomen in the use of e-mail and the creation of websites. It also supports educational processes both for Indigenous children and for the local authorities. It provides services to human rights activists, and it has a special program in place for Indigenous women.

The tele-center plays a very important social role in the community, and it has a strong network at a local level. This organizational capacity was illustrated well during the rescue and reconstruction efforts following the tragedy caused by hurricane Stan in 2005.

Having such a solid base at a local level, Asodigua is part of the network called Somos Telecentros. As evident in its website, Somos Telecentros has allowed access to many experiences, strengthening the Indigenous peoples’ abilities, including their capacity to assist themselves mutually in matters that go way beyond technological labours. Asodigua is a clear example of the advantages of belonging to a global network of tele-centers.

http://arpapallo.net/Asodigua/index.php?pagina=1

Yet, beyond networks of tele-centers, there are more comprehensive Indigenous communication networks. This section already has mentioned the Indigenous Regional Council of Cauca as a network that has been able to expand to all areas -- to such an extent that at the time of writing this document it is one of the main organizers of the Continental Indigenous Communication Summit. It is without doubt an example of a sustained network, with a solid base, that has been able to organize itself by reflecting
on its local requirements and addressing them in the international environment.

4.5.2 Are we heading in the right direction?

- Is the local network consolidated?
- Are the majority of groups who operate in the community participating in the local network?
- Are there concrete expectations from a national and a global network?
- What contribution can the digital center make to a national or global network?
- What global actions can directly or indirectly influence local actions?

4.6 Telling and reflecting the local story

Jen Pøj is an Ayuc Indigenous radio station in Mexico. Each year it arranges a big anniversary party for all of its listeners, their friends from the networks to which they belong, the projects in which they participate, and the town, which brims with colour and overflows with festivities and cultural activities on that day. But along with the party there is a collective reflection. The Ayuc celebrate, but they also think about their radio station and about Indigenous radio in general. They listen to the experiences from other guests and contemplate whether they are walking in the path that the community has traced for them and for itself.

This is just an example of a community-based media outlet that reviews, observes and critiques itself according to the life plan of the people it serves. This is an essential part of an Indigenous access center.

Suggested reading

5 What have we learned?

As we have seen throughout this module, the use of ICTs for the development of Indigenous peoples and isolated communities goes way beyond the supply of connectivity to a school. Connectivity is just a link in a long chain of actions required for the ICTs to be used for the benefit of the communities. In this task, the government and the communities have mutual responsibilities that need to be fulfilled so that the ICTs are truly a tool that contributes to development.

5.1 Administration and management

Throughout this module, best practices and mistakes have been highlighted regarding deployment of ICTs in Indigenous communities, either by means of community Internet access centers in schools, or through the deployment of wider connectivity from the connected schools.

We have already given some general guidelines that are necessary to work towards the sustainable development of ICTs in isolated communities, which do not need to be repeated in this section. Nevertheless, it is important to highlight, as a conclusion, that in order to assure the sustainability of the connectivity projects in isolated areas, there must be an integrated strategy that takes into account all of the aspects of an enabling environment, especially the participation of the addressed communities.

The world is full of examples of ICT development strategies whose success is only superficial. They are strategies that flaunt massive deployment of digital centers, but when reviewed under usefulness and sustainability criteria, they are truly a failure.

The steps presented in this module do not guarantee immediate results or growth in connectivity over short periods, but they provide the basis for a long-term, integrated strategy that will result in solid projects, which in turn will allow the development of more ICT projects.

The proposals presented in this module imply initial actions that may not immediately reflect a rise in the indicators of tele-density or community access to ICTs. But once the key steps have been
undertaken, they will lead to exponential growth in connectivity and in applications, as demonstrated by some of the examples presented.

The administrations that choose a sustainable ICT development strategy in isolated communities will surely consider the contributions presented herein as useful.

5.2 Indigenous Communities

Those who have lived in Indigenous communities, or in communities where resources are scarce, have learned that the organized work of the community is the essential engine for the success or failure of projects. We know very well that, beyond the supply of economic resources, the most important feature is the organization of members of the community in the effective use of local resources, which apart from the available material resources, include their abilities and relationships with other people, communities and institutions.

Throughout this module, we have pointed out several essential elements that the communities must take into account when developing ICT projects in such a way that they assure their sustainability and applicability to the development objectives of the community.

In order to achieve ICT projects that match the development objectives of the communities, they need to carry out intense reflection and organizational work that can prompt the necessary actions to be performed in the communities. Thus, as we have already pointed out, it is an essential objective for the governments to open spaces for participation in all of the aspects related to the development of ICTs in isolated and Indigenous communities. But we also show that the communities themselves need to be prepared and organized to participate and assume the authority to make decisions inherent to their development.

5.3 Tailor-Made Solutions

Throughout this section, we have been able to see the complexity of the actions in ICT development matters, as well as the importance of the social, economic, geographical, political and cultural
characteristics of the location, which have to be taken into account in the design of the connectivity policies in isolated and Indigenous areas.

For this reason, under no circumstance can one recommend a model to be imported either from one country to another, or from one community to another. The design of strategies and policies must start with local and national realities, following the recommendations pointed out for the creation of an enabling environment.

Under no circumstance do we consider the recommendations presented as the finished item. It is possible that administrations and communities will find new aspects that must be considered. Thus, the Connect a School-Connect a Community platform is open to the incorporation of their experiences and recommendations, which will allow the continuous improvement of ICT development in rural and Indigenous areas.

Credits

The Module on Community ICT Centres for Indigenous Peoples was drafted by Mr. Erick Huerta Velázquez, Joint General Coordinator of “Redes por la Diversidad, Equidad y Sustentabilidad A.C.” (REDES), Mexico City (www.redesac.org.mx). REDES is an NGO that works on issues related to diversity, equity and sustainability, including “Communication for Development”. Mr. Huerta provides advice to several indigenous communication organizations at the national and international level, as well as to government bodies, to create better conditions for the development of communications in indigenous communities and remote areas.

References

1. Introduction

2. Who are the Indigenous Peoples?

3. What is the role of governments in creating an enabling ICT environment for Indigenous Peoples?

3.1 Introduction

- Promoting equitable access, meaningful use and appropriation of the Internet: recommendations for ECOSOC [http://www.idrc.ca/es/ev-4300-201-1-DO_TOPIC.html]

3.2 Regulation

Huerta, Erick “¿Qué significa crear condiciones para que los pueblos indígenas puedan adquirir, administrar y operar medios de comunicación?” Jurídica 37, 2007.

3.3 Infrastructure and Technology


3.4 Industry

• Galperin & Girard, Microtelcos in Latin America and the Caribbean, in Poverty Digital, the Prospects in Latin America and the Caribbean IDRC-2007?http://dirsi.net/sites/default/files/dirsi_07_DP05_en.pdf

3.5 Local Content


3.6. Capacity-Building

• National Competency Standars for Community eCenter Knowledge Workers telecentre.org-Philipine Community eCenter Academy http://www.itu.int/ITU-D/asp/CMS/ASP-CoE/2010/IRD/S7-Mr_Noel_Mendoza.pdf
• Wireless Networks in Developing Countries Third Edition http://wndw.net/download.html
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3.7 Participation

- Toolkit for Setting up Rural Knowledge Telecentres; M S Swaminathan Research Foundation
- Medellín, S. Uso de las TIC para el Desarrollo Local: Apropiación Comunitaria de Telecentros
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  manual-taller-participativo-telecentros-1
Module 4: Using ICTs to promote education and job training for persons with disabilities

Introduction

‘If anybody asks me what the Internet means to me, I will tell him without hesitation: To me (a quadriplegic) the Internet occupies the most important part in my life. It is my feet that can take me to any part of the world; it is my hands which help me to accomplish my work; it is my best friend – it gives my life meaning.’ -- Dr ZhangXu

Children with disabilities in developing countries face particular difficulties in accessing the most basic forms of education. They face the lowest levels of access to education of any cohort of students. Of the 75 million children of primary school age worldwide who are out of school, one third are children with disabilities. Information and communication technologies (ICTs), and in particular assistive technologies (ATs), can provide students with disabilities access to traditionally inaccessible educational content through electronic and online learning channels. Connected schools, with the right mix of ATs, can provide children with disabilities unprecedented access to education.

Connected, accessible schools can also be leveraged as community ICT centers, facilitating job-skills training and even providing employment opportunities for youths and adults with disabilities in the wider community. This module will also show how connected, accessible schools can be developed into accessible Multipurpose Community Telecenters (MCTs).

The barriers to education faced by children with disabilities in developing countries are complex. They include barriers associated with societal and attitudinal belief systems that maintain that it is not possible to educate children with a sensory, physical or cognitive disability.

In Section 1, this module primarily concentrates on how accessible ICTs can facilitate connected schools that provide equal access to education for children with disabilities. Section 2 examines the situations many persons with disabilities face in developing countries when trying to receive an
education or job-skills training. Section 3 examines the types of accessible ICTs, ATs and accessible formats and media that enable an equitable educational experience. It also examines issues of cost and the development of local and national technology eco-systems capable of supporting and sustaining the development of, and training in, accessible ICTs. Best practices in the development and implementation of ICT accessible schools are provided in Section 4. The potential of these schools to be leveraged as accessible MCTs that provide job-skills training and employment opportunities is dealt with in Section 5. Section 6 provides a checklist of key steps for policy-makers in ministries of education, communication, local government and local schools boards to achieve accessible, connected schools. Section 7 outlines the significant body of international legislation and policy on the rights of children with disabilities to an inclusive education in mainstream schools, and the important role of accessible ICTs in achieving these rights. Meanwhile, Section 8 provides case studies and best practice examples of accessible ICTs in action, and Section 9 provides a range of resources for teachers and policy-makers.

1 http://www.icdri.org/inspirational/no_disability_in_digitalized_com.htm


1 ICT use for education and job training for persons with disabilities

Children with disabilities in developing countries face particular difficulties in accessing the most basic forms of education. They face the lowest levels of access to education of any cohort of students. Of the 75 million children of primary school age worldwide who are out of school, one third are children with disabilities. Information and communication technologies (ICTs), and in particular assistive technologies (ATs), can provide students with disabilities access to traditionally inaccessible educational content through electronic and online learning channels. Connected schools, with the right mix of ATs, can provide children with disabilities unprecedented access to education.
1.1 What are accessible ICTs

Accessible Information and communication technologies (ICTs) have the potential to provide persons with disabilities unprecedented levels of access to education, skills training and employment, as well as the opportunity to participate in the economic, cultural and social life of their community.

ICTs encompass a wide range of hardware and software, devices and computers, formats and systems that enable communication through electronic means. The definition of ICT covers everything from the storage, processing and retrieval of electronic information to the array of devices and software used to retrieve this information, as well as those used to communicate, in real-time, with other people.

The UN Convention on the Rights of Persons with Disabilities\(^4\) defines communications to include

“Languages, display of text, Braille, tactile communication, large print, accessible multimedia as well as written, audio, plain-language, human-reader and augmentative and alternative modes, means and formats of communication, including accessible information and communication technology.”\(^5\)

An accessible ICT product or service is one that can be used by all its intended users, taking into account their differing capabilities. A person’s ability to make inputs (e.g. type in text) and perceive outputs (e.g. read text on a screen) may be impaired. This can be either permanent or temporary, and may be due to various physical, mental or environmental conditions.\(^6\)

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\(^3\)http://data.un.org/Data.aspx?q=disability&d=SOWC&f=inID%3a150

\(^4\)Full text of the UN Convention on the Rights of Persons with Disabilities is available here:

\(^5\)Article 2 Definitions

\(^6\)http://universaldesign.ie/useandapply/ict/universaldesignforict/introductiontoaccessibility#introduction

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CONNECT A SCHOOL, CONNECT A COMMUNITY connectaschool.org
1.1.1 Examples of accessible ICTs

To illustrate how all these elements work together to make an accessible experience for a person with a disability, we will look at two scenarios.

Making a call on a mobile phone

A person with a hearing impairment wishes to make a call on a mobile phone. This person uses a piece of assistive technology (AT) called a hearing aid, which helps amplify sounds from the person's surroundings. An accessible experience is only possible in this instance if the hearing aid and the mobile phone are compatible with one another. If they are not, it is likely that the person will hear a loud whining noise, known as feedback, when the phone is placed near the hearing aid. Once the hearing aid and the phone are compatible, the person can make and receive a phone call in the same way as a person without a hearing impairment.

Browsing a website

Consider a blind person who wishes to browse a website using a personal computer. In this slightly more complicated scenario, the person uses a sophisticated piece of AT called a "screen reader," which is capable of converting text on the computer screen into synthesized speech. The person can also navigate around a website and input text into an online Web form by using this screen reader in conjunction with a standard keyboard. In this scenario, several things must happen for the person to have an accessible experience.

1. A localized version of the screen reader (i.e. adapted to local requirements in terms of language and culture) must be available.

2. The person must have access to, and be trained, in using the screen reader.

3. The screen reader and the PC must be "interoperable" or compatible -- i.e., the screen-reading software must be able to control the browser and the operating systems on the computer.

4. The Web content on the website the person is browsing must also be designed to be accessible, for which there are international standards.
Once these conditions are in place, it is feasible for a blind person to access the same content and carry out the same tasks online as any other person.

http://portal.bibliotekivest.no/terminology.htm#L

1.2 Toward a definition of accessible ICTs

Defining Disability

The definitions of disability used in national policies, legislation and disability statistics vary significantly throughout the world. Figures on the prevalence of disability worldwide used in this module are based on those from the World Bank. The UN Convention on the Rights of Persons with Disabilities recognizes the cultural and economic differences in which these national definitions of disability operate, and does not seek to provide an overarching definition. Instead it simply states:

“Persons with disabilities include those with long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with other[s]” (Article 1)

However, the Convention does move toward a view of disability resulting from the barriers within society (such as steps at the entrance of a building for a wheelchair user) and away from the view that disability results exclusively from a person’s medical condition.

Similarly, the World Health Organization’s (WHO) definition of disability, which is contained within its International Classification of Functioning (ICF), Disability and Health, known as ICF, borrows from this social model. It conceptualizes disability as "a dynamic interaction between health conditions (diseases, disorders, injuries, traumas, etc) and contextual factors." The ICF model has two components: the first looks at the issues of functioning and disability (the individual’s body functions and structures), while the second part looks at the environment and context in which the person lives and how these factors impact on the individual’s participation in society. It points to a dynamic interaction between health conditions (diseases, disorders, injuries, traumas, etc) and contextual factors. The ICF moves away from the so-called “medial model” notion of an assumed "norm" of
human ability and firmly embraces the notion of society as an active agent in the quality of life of the individual.

**Defining Accessible ICTs**

The term *accessible ICTs*, as used in this module, covers a full range of assistive and mainstream technologies and formats that can enable a student with a disability to enjoy an inclusive education. Assistive technology (AT) is a “piece of equipment, product system, hardware, software or service that is used to increase, maintain or improve functional capabilities of individuals with disabilities.”

Accessible ICTs include:

- Mainstream technologies, such as computers and mobile phones that contain in-built accessibility features;
- Assistive technologies, such as hearing aids, screen readers, adaptive keyboards, etc.; and
- Accessible formats, such as accessible HTML (Hypertext Markup Language), DAISY (Digital Accessible Information System) books, etc.

Section 3 and Section 4 provide further information on these technologies, and also discuss issues of affordability, availability, personalization, interoperability, and accessibility features on mainstream computers and mobile phones, as well as training and support.


9 Full text of the UN Convention on the Rights of Persons with Disabilities is available here:

10 http://www.who.int/classifications/icf/en/ International Classification of Functioning, Disability and Health (ICF) ICF describes how people live with their health condition. ICF is a classification of health and health related domains that describe body functions and structures, activities and participation. Since an individual’s functioning and disability occurs in a context, ICF also includes a list of environmental factors.

Note: AT is a generic term that includes assistive, adaptive, and rehabilitative devices for people with disabilities and includes the process used in selecting, locating, and using them. [http://en.wikipedia.org/wiki/Assistive_technology](http://en.wikipedia.org/wiki/Assistive_technology)

### 1.2.1 The benefits of accessible ICTs in connected schools

A meta-study on research into use of accessible ICTs showed that it brings the following benefits to all stakeholders involved in education, including students, teachers, parents and care-givers:

**General benefits:**

- Enables greater learner autonomy
- Unlocks hidden potential for those with communication difficulties
- Enables students to demonstrate achievement in ways which might not be possible with traditional methods
- Enables tasks to be tailored to suit individual skills and abilities

**Benefits for students:**

- Computers can improve students' independent access to education
- Students with special educational needs are able to accomplish tasks working at their own pace
- Visually impaired students using the Internet can access information alongside their sighted peers
- Students with profound and multiple learning difficulties can communicate more easily
- Students using voice communication aids are able to gain confidence and social credibility at school and in their communities
- Increased ICT confidence amongst students motivates them to use the Internet at home for schoolwork and leisure interests.
Benefits for teachers and non-teaching staff:

- Reduced isolation for teachers working in special educational fields, enabling them to communicate electronically with colleagues
- Support for reflection on professional practice via online communication
- Improved skills for staff and a greater understanding of access technology used by students
- Enhanced professional development and improved effectiveness in using ICTs with students, through collaboration with peers
- Materials already in electronic form (for example, from the internet) are more easily adapted into accessible resources such as large print or Braille materials.

Benefits for parents and care-givers:

- Use of voice communication aids encourages parents and care-givers to have higher expectations of children’s sociability and potential level of participation.


1.3 The United Nations Convention on the Rights of Persons with Disabilities (UN CRPD)

The UN Convention of the Rights of Persons with Disabilities places significant obligations on all state officials responsible for equal access to education and employment opportunities.13 The Convention contains a number of innovative and progressive concepts on the enjoyment of human rights by persons with disabilities.14 The Convention holds that the accessibility of ICTs is equally important as the accessibility of other domains, such as the built environment and transportation.

The Convention moves toward a view of disability resulting from barriers within society (such as steps at the entrance of a building for a wheelchair user) and away from the view that disability results exclusively from a person’s medical condition. This paradigm shift, from the medical to the social model of disability, puts the focus on giving persons with disabilities access to society and its structures --
what is commonly known as "accessibility." A second innovation within the Convention is the position that access to ICTs for persons with disabilities plays a pivotal role in overcoming many of these societal barriers.

The Convention was adopted by the UN General Assembly on 13 December 2006, and became an enforceable legal instrument on the date when the 20th ratification occurred, 5 May 2008. As of September 2010, 147 countries had signed the Convention, of which 93 had subsequently ratified it.\(^{15}\)


http://www.un.org/disabilities/default.asp?navid=23πd=151#iq1

Updates on the number of signatories to the Convention, its Optional Protocol and the number of ratifications can be found here: [http://www.un.org/disabilities/](http://www.un.org/disabilities/)

### 1.3.1 Dispositions on ICT accessibility

Accessibility is the one over-arching general principles contained in Article 3 of the Convention. Article 9 on accessibility specifically mentions access to ICTs as a key enabler for the enjoyment of other rights, such as the right to an inclusive education and the right to work.

The definition of *communication* in Article 2 states that it includes:

> "Languages, display of text, Braille, tactile communication, large print, accessible multimedia as well as written, audio, plain-language, human-reader and augmentative and alternative modes, means and formats of communication, including accessible information and communication technology."\(^{16}\)

The CRPD specifically mentions terms for assistive technology in eight of its articles between Article 4 and Article 32 (i.e., Articles 4, 9, 20, 21, 24, 26, 29, and 32). Measures that could include assistive technology (e.g., "take all appropriate measures") are mentioned in an additional 17 articles.\(^{17}\)
Defining Universal Design

The Convention recognizes the risk of exclusion resulting from advances in technology, if the requirements of all end users -- including persons with disabilities -- are not taken into consideration. This is addressed in the Convention through the concept of universal design, which is

“The design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. ‘Universal design’ shall not exclude assistive devices for particular groups of persons with disabilities where this is needed.” (Article 2)

Article 4 contains a specific recommendation that all new technology developments be “universally designed.” This helps reduce the cost of including accessibility features by incorporating them at the earliest possible stage during the product development cycle.

The Convention also holds that in and of itself, access to information about assistive technologies is important, placing an obligation on government officials

“to provide accessible information to persons with disabilities about mobility aids, devices and assistive technologies, including new technologies, as well as other forms of assistance, support services and facilities” (Article 4 (1) (h))

Article 26, on “habilitation and rehabilitation,” also emphasizes the importance of the “availability, knowledge and use of assistive devices and technologies” as they relate to rehabilitation as a means to attain independence and autonomy through, among other things, access to education (Article 24) and employment (Article 27).

16Article 2 (1)

1.3.2 Education

In its preamble, the Convention recalls Article 36 of the *UN Declaration of Human Rights*, which states that everyone has a right to education.

**Defining Inclusive Education**

The Convention recognizes that access to education is a fundamental right of persons with disabilities. Education is to be provided, wherever possible, in an “inclusive” manner; that is, within the context of the mainstream educational system and not in a segregated setting. Article 24 contains specific obligations that include the provision of “reasonable accommodations” for students with disabilities. These may include, as appropriate, access to (along with training in, and use of) accessible ICTs, including assistive technology and educational materials in an accessible format.

**Defining Reasonable Accommodation**

As defined in Article 2, reasonable accommodation is a key enabler for persons with disabilities to enjoy equal rights. Reasonable accommodation means the provision of adjustments and accommodations to ensure that a person with a disability can enjoy or exercise their human rights on an equal basis with other individuals. A reasonable adjustment should be both necessary and appropriate and should not impose a disproportionate burden on the accommodator.

One example of a reasonable accommodation in the educational context may be the provision of the appropriate assistive technology that is necessary for a person with a disability to access education on an equitable basis with their peers. Article 2 also states that denial of reasonable accommodation is a form of “discrimination on the basis of disability.” Article 5 further emphasizes this by stating, “In order to promote equality and eliminate discrimination, State Parties shall take all appropriate steps to ensure reasonable accommodation is provided.”

**Staff Training and Peer Support**

Article 24 also contains an important requirement pertaining to the professionals and staff members who work in all areas of education. They should be given “disability awareness training and [training in] the use of appropriate augmentative and alternative modes, means and formats of communication, educational techniques and materials to support persons with disabilities.”
Article 26 (on rehabilitation) emphasizes the importance of peer support. This is particularly relevant in the training in and use of accessible ICTs in educational and job training settings.

1.3.3 Employment

Article 27 of the Convention emphasizes the “right of persons with disabilities to work on an equal basis with others; this includes the right to the opportunity to gain a living by work freely chosen or accepted in a labour market, and [a] work environment that is open, inclusive and accessible to persons with disabilities.” Article 27 also mandates that “reasonable accommodation be] provided to persons with disabilities in the workplace.”

18 Article 27.1
19 Article 27.1 (i)

1.3.4 Implications for other policy areas

International cooperation

Article 4 (2) of the Convention places a specific obligation on government officials to use the framework of international cooperation “with a view to achieving progressively the full realization of these rights.” This obligation is further expanded in Article 32, which significantly recommends that international cooperation be used for the furthering and sharing of knowledge and capacity between nations in relation to “scientific and technical knowledge.” This is particularly relevant to the development of accessible ICT eco-systems, discussed further in Section 4.

Article 9 on Accessibility specifies that “State Parties shall also take appropriate measures to develop, promulgate and monitor the implementation of minimum standards and guidelines for the accessibility of facilities and services open or provided to the public.” (Article 9.2 (a))
Public procurement

Many governments have long used public procurement practices to achieve social inclusion goals. By specifying certain criteria for the good or service being purchased, public authorities can exert a significant influence on the quality of the goods and services for sale in the market. They can also spur innovation within industry to meet these requirements. For example, in the US and Canada public procurement policies require that any ICTs purchased by the federal government to be accessible to persons with disabilities.\(^{20}\) This has had a profound effect on the accessibility of many mainstream products such as computer operating systems, printers and mobile phones. It has given industry an incentive to innovate and provide cost-effective, accessible solutions by making accessibility a competitive criterion in public procurement competitions. So public procurement can be a way to foster standards and enable governments to influence the development and availability of accessible ICTs.

This also impacts on the wider accessible-ICT eco-system by creating a demand, and therefore a capacity within the market, to develop, produce and maintain accessible ICTs. The greater the demand, the lower the ultimate costs are likely to be. Public procurement policy can therefore act a means to promote the development and availability of accessible ICTs.

The role and development of public procurement policy is discussed further in Section 4.

\(^{20}\)http://e-accessibilitytoolkit.org/toolkit/public_procurement/case_studies

1.3.5 Summary of accessible ICT obligations

With regard to accessible ICTs, employment and education, the obligations of government officials under the *UN Convention on the Rights of Persons with Disabilities* are:

- In general, accessible ICTs should facilitate the enjoyment of many other rights, including access to education and employment.
- Access to ICTs, including the internet, are to be given the same priority as access to buildings and transportation.
• The universal design of mainstream products and ICTs that are accessible to persons with disabilities are to be promoted through research and the development of appropriate guidelines and standards.
• Research and development and promotion of new accessible ICTs, including assistive technologies, are to be undertaken with an emphasis on affordable solutions.
• Professionals and staff working with persons with disabilities should receive training on these rights and how they can be realized. This includes training as appropriate for teachers, educators, care workers and job trainers on how accessible ICTs can be used to provide access to education and job training.

1.4 Summary of other international laws and initiatives in support of accessible ICTs in inclusive education

Figure 1.1 shows the history of many of the human rights and, more recently information society, conventions and international agreements in support of the use of accessible ICTs in inclusive education.

Figure 1.1 Overview of legal frameworks in support of the use of accessible ICTs in inclusive education
The following subsections summarize the main initiatives and international organizations with a remit to promote accessible ICTs and inclusive education. Section 8 contains more details on international texts, initiatives and goals in this area.

### 1.4.1 World Summit on the Information Society

The World Summit on the Information Society, organized by the International Telecommunication Union (ITU), established a common vision for building an Information Society for all, and provided a framework to translate that vision into action. The WSIS Plan of Action contains many commitments on the development of an Information Society that enables the education, training and employment of persons with disabilities. These include:

- **C2 Infrastructure** -- “Encourage the design and production of ICT equipment and services so that everyone has easy and affordable access to them, including older people, persons with disabilities, children, especially marginalized children, and other disadvantaged and vulnerable...
groups, and promote the development of technologies, applications, and content suited to their needs, guided by the Universal Design Principle and further enhanced by the use of assistive technologies.”

• **C3 Access to Information and Knowledge**: “Adaptation of ICT infrastructure, tools and applications that facilitate accessibility of ICTs for all, and disadvantaged groups in particular.”

• **C4 Capacity Building**: “Address the need to ensure the benefits offered by ICTs for all, including disadvantaged, marginalized and vulnerable groups.”

1.4.2 The International Telecommunication Union

The International Telecommunication Union (ITU) is the lead United Nations agency for information and communication issues and is the global focal point for governments and the private sector in developing networks and services. ITU works to improve the telecommunications infrastructure of the developing world and has a specific strategy on accessibility. This strategy focuses on:

- making technical design standards accessible
- supporting the rights of persons with disabilities,
- providing training on accessible ICT

Examples of ITU’s work and collaborations include:

- “Total Conversation” – ITU-T Rec.F.703. Total Conversation is an ITU service description that covers videophone with real time text. It is an audiovisual
conversation service providing real-time video, text and voice that is not only useful for persons with disabilities but also for anyone requiring textual back-up, technical data, language translations, verbal or signed conversations.

Joint ITU/G3ict “e-Accessibility Policy Toolkit for Persons with Disabilities”. This online toolkit is designed to assist policy makers to implement the ICT accessibility dispositions of the UN Convention on the Rights of Persons with Disabilities.

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23http://www.itu.int/ITU-T/studygroups/com16/accessibility/conversation.html

1.4.3 United Nations Educational, Scientific and Cultural Organization (UNESCO)

UNESCO leads the global Education for All movement, aimed at meeting the learning needs of all children, youth and adults by 2015. UNESCO promotes the ultimate goal of inclusive education, which it views as a means to ensure a quality education for all and to achieve wider social inclusion goals. Key policy documents and agreements that UNESCO has developed and facilitated include:

- Guidelines for inclusion: Ensuring Access to Education for All  
- Policy Guidelines on Inclusion in Education 2009  
- Salamanca Declaration (1994).

UNESCO promotes the development of inclusive schools; that is, schools that “accommodate all children regardless of their physical, intellectual, emotional, social, linguistic or other conditions.” It views inclusive education not as a synonym for special needs education or integration techniques, but an “as an on-going process in an ever-evolving education system, focusing on those currently excluded from accessing education, as well as those who are in school but not learning.”

In developing countries, many educational systems struggle to provide a quality education in mainstream schools and favour the development of special needs schools. Worldwide, many countries have developed a two-tier educational system composed of mainstream and special needs schools.
UNESCO advocates that wherever possible, children with disabilities should be accommodated in inclusive schools, which it promotes as being more cost-effective and which lead to a more inclusive society.

1.4.4 UNICEF - 1989 United Nations Conventions on the Rights of the Child

The UN Children’s fund, UNICEF, works for children’s rights, survival, development and protection. It is guided by the 1989 Convention of the Rights of the Child. This international convention contains specific references to the right of children with disabilities to be protected from all forms of discrimination (Article 2). Article 23 directs parties to the Convention to promote a life of dignity, self-reliance and “active participation in the community.”

Assistance should be extended to ensure that children with disabilities receive “education, training, health care services, rehabilitation services, [and] preparation for employment and recreation
opportunities” (Article 23 (3)). Government officials are also encouraged to cooperate internationally to ensure that “information concerning methods of rehabilitation, education and vocational service” are shared in order to build capacity and experience in these areas (Article 23 (4)).

30 http://www.unicef.org/


1.4.5 The Millennium Development Goals

The Millennium Development Goals (MDGs) have set a target of full enrollment and completion of primary school for all children by 2015.32 The 2010 MDG Report showed that while enrollment in primary education has continued to rise, reaching 89 per cent in the developing world, the pace of progress is insufficient to reach the target by 2015.33 To achieve the target, all children of school-going age would have had to be enrolled in primary education by 2009, yet in sub-Saharan African countries, for example, at least one in four children was out of school in 2008.

The 2010 MDG report showed that even in countries that are close to achieving universal primary education, the percentages of children with disabilities not enrolled remained disproportionately high. In Bulgaria and Romania, net enrollment percentages for children aged 7 to 15 were over 90 per cent in 2002, but only 58 per cent of children with disabilities in that age group were enrolled in school.

32 UN Millennium Development Goals, “Goal 2: Achieve universal primary education” Target “Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling”. http://www.un.org/millenniumgoals/education.shtml

33 Millennium Development Goals 2010 Report
1.4.6 Conclusions

The body of international policy and legislation on the rights of persons with disabilities is strongly in support of children with disabilities receiving their education in an inclusive, rather than segregated, school setting. National governments, therefore, have significant human rights and educational work to do in relation to the provision of education for children with disabilities. The major tendency in new policy approaches is towards inclusive education. Whatever the policy environment, accessible ICTs can significantly empower children with disabilities to participate in lessons, to communicate, and to learn more effectively.

34 IITE page 17

2 The Current situation, challenges and opportunities

"UN Millennium Development Goal 2: Achieve Universal Primary Education
Target 1: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling"

Children with disabilities have to combat blatant educational exclusion. Of the 75 million children of primary school age worldwide who are out of school, one-third are children with disabilities. UNESCO estimates that 90 per cent of children with disabilities in developing countries do not attend school. In total, an estimated 186 million children with disabilities worldwide have not completed their primary school education. Thus, children with disabilities make up the world’s largest and most disadvantaged minority in terms of education.
2.1 Statistics on children with disabilities receiving education

There are very few statistical studies that can point to the number of children with disabilities who receive education. Recent reports, such as the *Education for All Global Monitoring Report 2010*, show modest improvements in some countries over some previous reports. UNESCO has conducted significant research into the plight of children with disabilities in developing countries. It reports that exclusion from education “is particularly more serious among persons with disabilities, of whom approximately 97 per cent do not have the basic reading and writing skills.” Literacy rates are as low as 1 per cent for women with disabilities. In its briefing paper on “Children out of School,” UNESCO states that most children with disabilities in developing countries are not attending school, and there is “no inclusion of those with physical, emotional or learning impairments within the education system.”


One estimate from China suggests that “there are 8 million disabled children while special schools cater for approximately 130,000” Watkins, K (2000), *The OXFAM Education Report*. OXFAM.
2.2 Associated levels of literacy and poverty

As a result of the low levels of school enrollment and attendance by children with disabilities, the literacy rate for adults with disabilities is just 3 per cent and, in some countries, as low as 1 per cent for women with disabilities. Poverty and disability are closely linked. The World Bank estimates that 20 per cent of the poorest people are disabled. An estimated 30 per cent of the world’s street children have a disability. The quality of life of persons with disabilities in developing countries is significantly lower than that of their peers. In most countries, persons with disabilities tend to be regarded as the most disadvantaged sector within their society. Women with disabilities experience exclusion due to both their gender and their disability.

The vast majority of persons with disabilities are cared for exclusively by their families. In developing countries, persons with disabilities are not expected to work and many can only receive an income through begging. According to the International Labour Organization (ILO), some 470 million people with disabilities are of working age worldwide. Yet, unemployment among the disabled is as high as 80 per cent in some countries.
Of the some 70 million persons with disabilities in India, for example, only about 100,000 have succeeded in obtaining employment in industry.

2.3 Reasons for exclusion

The reasons that children with disabilities do not attend school in developing countries are complex. It is increasingly accepted that the so-called medical model of disability often serves to stigmatize persons with disabilities while inadequately dealing with wider issues of exclusion from a person’s society, environment and culture. Under the social model of disability, conversely, the main barriers to access for children with disabilities can be summarized as follows:

• Attitudinal – Social or institutional attitudes that persons with disabilities cannot or should not be educated.

• Physical – Most schools are not designed to accommodate the needs of children with disabilities. Inaccessible entrances, toilet facilities, corridors and doorways for people with physical or sensory disabilities make physical access to school buildings difficult and often impossible.

• Pedagogical – There is little or no training of teachers in meeting the educational and communication needs of children with disabilities.

• Infrastructural – No transportation (or inaccessible transportation) is provided to enable children with disabilities to travel to school. One survey in Bangladesh found that parents of children with disabilities saw the absence of a specialized transport system from home to school in rural areas, and the lack of subsidized support for rickshaw transport, as major constraints.

• Policy – While most countries have a policy framework to support inclusive national educational systems, many do not have strategies in place to address the barriers preventing children from attending school. Indeed, the grossly inadequate level of support for children with disabilities in general schools often drives parents and groups representing persons with disabilities to demand separate provision of educational services.
The WHO report on “Children out of School” stated that children with disabilities in Uganda are often chased away from school. Though no reasons are given for this, another report on attitudes towards persons with disabilities in Nigeria points to a general belief in most ethnic groups that a person’s disability is a result of a curse from God or an act of witchcraft. EFA Global Monitoring Report 2010 http://unesdoc.unesco.org/images/0018/001866/186606E.pdf

For example, in 2005, just 18 per cent of India’s schools were accessible to children with disabilities, in terms of facilities such as ramps, appropriately designed classrooms and toilets, and transport. EFA Global Monitoring Report 2010 http://unesdoc.unesco.org/images/0018/001866/186606E.pdf

(Ackerman et al., 2005). cited in EFA Global Monitoring Report 2010


2.4 The costs of inclusive education

There is little available data on the exact costs of educating children with disabilities, although some figures show that it can be two to four times higher than for other children. UNESCO points to the experience in Europe, where the higher costs associated with educating children with special needs is associated with funding models where children are educated in separate settings such as special needs schools. Lower funding costs were shown to generally apply where the funding "followed" the child into inclusive educational settings. Research also suggests that students with disabilities achieve better school results in inclusive settings.

There is some evidence to suggest that an inclusive and high-quality educational system leads to lower numbers of students needing to repeat classes and entire academic years. UNESCO has pointed to the case of Latin America, where recidivism is linked with a cost of USD 5.6 billion in primary school and USD 5.5 billion in secondary school. Investment to overcome those costs could include the provision of ICTs for students with disabilities.
It has been the experience of many countries that, in line with the UN Convention’s recommendation on Universal Design, incorporating the requirements of students with disabilities into the design of buildings and services reduces costs significantly. In its National Report at International Conference on Education (ICE), the Afghani Ministry for Education reported that “the additional costs of construction [of] schools for all according to the principles of universal design are minimal.”

UNESCO recommends that any cost modeling of inclusive education should take into account the high social and economic costs that a country will incur if its children are not educated. UNESCO studies estimate that excluding persons with disabilities from the work force of a country can cause a loss of gross domestic product (GDP) of between 10 and 35.8 per cent. Overall, the long-term social and financial costs of not providing an inclusive education that leads to participation in the economic, social and cultural life of a country are “indisputably high.” UNESCO concludes that not to invest in inclusive education is “profoundly irrational” in economic terms.

53 http://www.inclusion.com/resoecd.html


55 UNESCO. Guidelines for Inclusive Education, page 12


58 http://unesdoc.unesco.org/images/0017/001778/177849e.pdf

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### 2.5 Numbers of people with disabilities world wide

In its 2007 report, “Measuring Disability Prevalence,” the World Bank estimated the number of persons with disabilities at between 10 and 12 per cent of the global population.\(^{59}\) Using the United Nation’s “World Population Prospects 2008,”\(^{60}\) which indicates a global population of slightly more than 6.9 billion people in 2010, Table 2.2 shows the estimated global population of people with disabilities as just under 830 million people (691-829 million people) by the end of 2010. That number is expected to exceed 1 billion (915 million – 1.1 billion) before the midpoint of the 21st century. Statistics show that approximately one in five persons with disabilities are born with their disability, while most acquire it after age 16, mainly during their working lives.\(^ {61}\) Approximately 20 per cent of these are children with disabilities.

Table 2.1: Global population of persons with disabilities

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Population</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(millions)</td>
<td>6,909</td>
<td>7,675</td>
<td>8,309</td>
<td>8,801</td>
<td>9,150</td>
</tr>
<tr>
<td>Medium variant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimates of global population of persons with disabilities (imputed as 10-12%, in millions)</td>
<td>691-829</td>
<td>768-921</td>
<td>831-997</td>
<td>880-1,056</td>
<td>915-1,098</td>
</tr>
<tr>
<td>Estimate of global population of children with disabilities (imputed as 2-3%, in millions)</td>
<td>140-165</td>
<td>154-184</td>
<td>166-199</td>
<td>176-211</td>
<td>183-220</td>
</tr>
</tbody>
</table>


61 Forum on Disability briefing for CSR practitioners, Disabled employees: Labour standards, an Employers*, Available at www.csreurope.org/csrinfo/csrdisability/Disabledemployees

### 2.6 Implications of a global aging population

Many commentators have predicted that the actual figures of persons with disabilities worldwide may be higher than these estimates. Figure 2.2 shows the share of persons 50 years and older by region. Another factor likely to influence the numbers of person with disabilities is the increase in percentages of older people in the world population and the associated prevalence of age-related disabilities.

**Figure 2.2: Share of 50+ population by region**

People are likely to develop new difficulties and impairments as they age – whether they are sensory (vision and hearing), cognitive (thinking and communication) or motor (locomotion, reach and stretch, and dexterity). Likewise, people with existing mild difficulties and impairments may experience an increase in their severity. In any population in which the age profile is getting older, the total number of people with difficulties and impairments will increase.62

The steadily increasing population of people over the age of 65 brings with it a reduction in the “old-age dependency ratio” (ODR).63 The ODR is the ratio of people aged 15-64 in the population per one person aged 65 or older in the population. In 1950 the worldwide ODR was 12:1; in 2000 the ODR was 9:1; by 2050 it is expected to be 4:1 globally. Figure 2.3 shows these dependency ratios for various types of economies.

**Figure 2.3 Old Age Dependency Ratios**
Population data from the UN’s “World Population Prospects 2008” shows that the less-developed regions (not including the least-developed countries) are projected to have the steepest growth in their old-age dependency ratios over the next 40 years. These regions are likely to experience a 200 per cent increase in the ratio of people over 65 to those of workforce age (age 15-64) between 2000 and 2050, as compared to the slightly more than 100 per cent increase predicted for the more developed regions and the slightly less than 100 per cent increase in the least-developed countries.

The bottom line is that many developing regions in the world will experience a steep increase in the numbers of people working to support those not working due to old age. With an increasing dependency ratio comes an increasing requirement for workforce productivity. Enabling persons with disabilities to access education -- and ultimately become employees through the use of accessible ICTs --will help offset this increasing dependency. The ITU/G3ict “e-Accessibility Policy Toolkit for Persons with Disabilities” provides guidance to policy-makers on calculating the benefits to a national economy of a more productive workforce enabled through the use of accessible ICTs.64

62Anne-Rivers Forcke, IBM, in ITU/G3ict “e-Accessibility Policy Toolkit for Persons with Disabilities”

63United Nation’s Programme on Ageing
3 Assistive technology by disability type: understanding users' needs

Accessible ICTs hold the potential to enable persons with disabilities to receive an education and become productive employees. Applied to education systems, accessible ICTs can provide equitable learning opportunities by enabling communication with teachers and fellow students, providing access to learning materials and by establishing a venue to complete course work, assignments and examinations. There are a wide variety of accessible ICTs currently available that can help overcome reduced functional capacity and enable communication, cognition and access to computers. Students with disabilities also require educational texts and online resources that are available in accessible formats.

Categories of assistive technologies (ATs) include stand-alone devices that aid mobility (e.g. wheelchairs) and communication (e.g. hearing aids). They also include hardware and software that enable access to a computer (e.g. an adaptive keyboard or screen reader). This section deals primarily with ATs that relate directly to a person’s ability to access a computer and participate effectively in an inclusive learning environment. Other concerns, such as accessibility of the building or computer workstations are also addressed.

A catalogue of ATs for ICT compiled for this module is a superset of the ISO/IEC FDIS 24751 Individualized Adaptability and Accessibility in e-Learning, Education and Training standard, which was created to facilitate the matching of individual user needs and preferences with educational digital resources that meet those needs and preferences.

Identifying the best assistive technology solution often requires an in-depth needs assessment to understand how a difficulty or impairment impacts computer use and/or access to an educational resource. The need for centers of expertise in AT is dealt with Section 4.

Ability as a spectrum
To begin to understand the complex variety of functional limitations that persons with disabilities experience, it is necessary to first appreciate the changing nature of human capability. No two people, whether with or without a disability, have exactly the same capabilities. Moreover, an individual’s ability to carry out a task can change according to a number of factors, including physical and mental fatigue, their environment and context of use. Consider, for example, a person with average eyesight trying to read a computer screen in an environment where very bright sunlight is reflected off the screen. It may be difficult or even impossible for that person to read the screen. A person may also experience reduced cognitive ability if working while fatigued or in a noisy or distracting environment. So it is important to view personal abilities to use ICTs as a spectrum that changes according to a wide range of factors.\(^6^5\) Thus, we can say the following:

- A disability may occur during a person's lifetime or may be present from birth;
- Categories of impairment include, but are not limited to, physical, sensory, cognitive and developmental;
- A disability may be permanent or temporary in nature;
- Disability may be the result of a combination of factors, including:
  - Functional limitations resulting from physical, psychiatric or psychological conditions;
  - Limitations in the design of an environment, product or ICT, and
  - Barriers associated with the attitudes of people and society; and
- As people get older, the prevalence of age-related disabilities increases.

### Educational Needs of children with disabilities

The special educational requirements of children with disabilities caused by a functional limitation are often called *special educational needs* (SENs), and they are both diverse and varied. UNESCO groups the roles that ICTs can play into three main categories:

- **Compensation uses** – Technical assistance that enables active participation in traditional educational activities, such as reading or writing.
- **Didactic uses** – The general process of using ICTs to transform approaches to education. Many ICTs can be used as a didactical tool to enable a more inclusive learning environment
- **Communication uses** – Technologies that can enable communication – often referred to as *alternative and augmentative communication devices and strategies*.\(^6^6\)
The following sections discuss the main categories of physical, sensory and cognitive disabilities and refer to best practices for ensuring that accessible ICTs enable learning in an inclusive school environment.

65 http://www.who.int/classifications/icf/en/ International Classification of Functioning, Disability and Health (ICF) ICF describes how people live with their health condition. ICF is a classification of health and health related domains that describe body functions and structures, activities and participation. Since an individual's functioning and disability occurs in a context, ICF also includes a list of environmental factors.


3.1 Persons with physical disabilities and motor impairments

Physical disabilities and motor impairments may result from traumatic injuries, such as spinal cord damage, or the loss of limbs due to diseases and congenital conditions such as Cerebral Palsy, arthritis or Parkinson’s disease. A range of issues should be considered to enable access for people with physical disabilities and motor impairments to a computer in a learning environment. These include (but are not limited to) the correct type of assistive technology, as well as the accessibility of the workstation and the building.

For some users, using a standard keyboard and mouse is possible, but due to tremor or low fine motor skills, default settings on the computer need to be adjusted to avoid continual errors. For other individuals, an alternative pointing or input device, such as a roller ball or switch, may be required. Users who are unable to access a keyboard using their hands or arms but have good head, neck and upper torso control may be able to type on the keyboard using a mouthstick or head/chin pointer.
3.1.1 Assistive technologies for physical disabilities and motor impairments

Mouse Alternatives and Replacements

Trackballs, joysticks and various forms of tablets are frequently easier to control than a mouse. The mouse pointer may also be controlled using head movements, which are tracked using infrared or ultrasound technology. Buttons on many alternative pointing devices can be programmed to perform a double click or to lock down the mouse button for a drag. Mouse buttons can be replaced with switches (e.g., puff-sip switches, foot pedal switches, etc.) or with software that performs the mouse click, double click, and drag by dwelling on a target for a predetermined time and then moving the mouse cursor in one of four directions.

The mouse pointer can be controlled using keys on the numeric keypad, or keys on an on-screen keyboard. Mouse emulators exist for single-switch users and users of voice recognition systems. These emulators employ a variety of strategies to quickly zero-in on the target.

![An arthritic hand trying to use a standard mouse](image)

**Figure 3.1** An arthritic hand trying to use a standard mouse

Keyboard Modifications and Alternatives

Free software or operating-system modifications allow changes to be made to keyboard responses by slowing response time, eliminating or slowing key repeat rates and holding keys used in multiple key depressions when selected sequentially. Standard keyboards are also available with on-board memory...
for text or command macros. Mainstream alternatives include keyboards that are smaller, more ergonomically shaped, provide more efficient keyboard layouts (e.g., DVORAK or QWERTY) and have built-in trackballs or other mouse alternatives.

Specialized keyboards have been developed to accommodate a variety of individual needs. Miniaturized keyboards accommodate those with limited range of movement or strength. These may have mouse emulation as a built-in feature. Enlarged keyboards are more suited to person with poor motor control but adequate range of movement. Programmable keyboards allow for customization of the keyboard layout (key content, key size), with individualized overlays depicting the key contents for the user. Keys may also be programmed with mouse emulation functions.

Numerous on-screen keyboard software programs allow the user to select keystrokes (e.g., letters, words, commands, phrases) using a mouse or mouse emulation.

**Switch Input**

Switch input devices can be used by persons who are unable to use a keyboard or mouse but who have good control of some other muscle groups. Switches can be used to emulate keyboard and mouse functions. Single, dual or three-switch input of Morse code, for example, can be translated by a hardware and/or software interface into keyboard and mouse inputs to the computer.

![Figure 3.2 A single switch mounted on a wheelchair](image)

**Voice Recognition**
Voice recognition of commands or text input is available with some operating systems. Continuous speech voice recognition software that provides text input, mouse control and software application control, including optional levels of vocabulary and macros for various professions or specialty groups, is also available. Although voice models in the system allow the recognition of words without explicit training, each user has their own voice model file, which should be adjusted to allow optimal recognition. Proper maintenance of the voice model requires vigilance to errors made by the user and the system and proper correction of the errors. Most voice dictation systems have very large dictionaries, but the user must add proper names and specialized vocabulary. Several dictation systems rely on mouse controls to navigate the desktop and dictation functions.

**Augmentative and Alternative Communication**

Many people with a severe physical disability may also have speech impairments. Augmentative and alternative communication (AAC) is a way of communicating, not only for those with speech impairment but also for those with difficulty in comprehending spoken or written language. AAC strategies vary from the use of symbols or gestures to the use of AAC devices such as (a) text-to-speech generating (Fig 3.3) devices and (b) speech generating (Fig 3.4) devices. While AAC strategies and devices are not an integral part of enabling computer access, they are essential in enabling two-way communication in an inclusive education, job-skil training or work environment with teachers, trainers, fellow students and work colleagues.

**Fig 3.3 Keyboard text-to-speech generating device**
Fig 3.4 Speech generating device

The following video shows how Ellen, an AT user, uses switches and an AAC device to communicate, access a computer and control her surroundings at home and at college.

3.1.2 Accessible buildings and workstations

In addition to providing the correct assistive technology, it is important that the design of the building does not present a barrier. To ensure that a school, training center or community center is accessible to persons with disabilities, builders should refer to appropriate building accessibility guidelines and national or regional building regulations. However, the following checklist provides some of the main areas to consider:

- External environment – e.g. parking spaces, entrance doors
- Horizontal circulation – e.g. internal door design and width, corridors, signage and way-finding
- Vertical circulation – e.g. internal stairs, elevators and ramps
- Facilities – e.g. accessible toilets
- Emergency egress – e.g. auditory and visual alarm systems, evacuation policies, evacuation chairs
- Accessible entrances – level entry or a mixture of steps and ramp

The path to the computer workstation must be free from obstacles such as steps, bins or furniture that would obstruct the progress of users who are either walking or using a mobility aid such as a wheelchair. This includes the path into any room or area containing the computer workstation. The user should be able to operate the computer from a clear, flat area with at least a 1.5 meter radius directly in front of the computer workstation to enable a wheelchair to turn (Fig 3.5). Ensure that users of all heights can reach all operable parts. The comfortable range is between 1200 and 900mm. The maximum acceptable reach height for wheelchair users is 1400mm (See Figure.3.6). There should be adequate lighting.
The United Nations has a useful set of anthropometrical data covering ranges of height and reach when standing or sitting in a wheelchair, plus required path and turning space dimensions for wheelchairs.\(^7\)

Figure 3.5 Wheelchair clearance and turning circle\(^7\)

Physical access to the computer itself is also a key consideration. Physical access may be improved by simply repositioning the user or the computer system. This can be accomplished by using height-adjustable chairs, computer tables, keyboard trays, or monitor arms. Many of these solutions can be quite costly, but by adhering to the principles of ergonomic design for workstations, it should be possible in many situations to adjust an existing workstation to better suit the needs of an individual.\(^7\)
Providing additional stabilizers or supports may improve control and reduce the risk of repetitive strain injuries.

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7412 ergonomic guidelines adapted from Cornell University studies help improve your computer working environment and comfort.” http://www.ergoindemand.com/ergonomic-computer-workstation-guidelines.htm

http://books.google.ie/books?id=A8TPF_O385AC&pg=PA316&lpg=PA316&dq=accessible+computer+workstation

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### 3.2 Assisting the blind or vision-impaired

There are an estimated 180 million people worldwide who have a visual impairment. Of these, 45 million persons are blind and 135 million have partial sight.75 Legal blindness is defined in many countries as a condition in which the best corrected visual acuity is 20/200, or less, or the person's
visual field is 20 degrees or less. Vision impairments include colour blindness, and vision disorders include cataracts, trachoma, glaucoma and macular degeneration.


For a further list of vision disorders see http://www.lighthouse.org/about-low-vision-blindness/vision-disorders/

3.2.1 Assistive Technology for blindness or vision impairment

Blind persons and persons with vision impairment can use a variety of assistive technologies to access computers and electronic content.

- **Enhancements to the visual display of the computer** - Adjustments can be made to the visual display using built-in system controls or free software. These adjustments provide higher contrast and can enlarge icons, display fonts and mouse cursors.

- **Screen magnification** - Screen magnification may be possible within the operating system of the computer. A large number of screen magnification programs are also available.

- **Alternatives to the visual display** - These include screen readers, which speak the text displayed on the screen, and refreshable Braille displays, which translate the text to Braille. Examples of screen readers include the following: JAWS, NVDA, Windows Eyes, Homepage Reader and ORCA.

- **Optical character recognition (OCR)** - Document scanners, in conjunction with OCR software, can translate printed text to electronic text that can be magnified or read aloud using the AT mentioned above.
• **Notetakers, or accessible Personal Digital Assistants (PDAs)** - These are specialized and portable combined hardware and software solutions that typically incorporate a refreshable Braille display and screen-reading functionality. Examples include Braille 'n Speak, Type 'n Speak, Braille Lite Millennium (or 2000), Type Lite, BrailleNote (and VoiceNote), PAC Mate and BrailleSense. These devices cost in the region of USD 6,000 or more.

• **Braillers** - Brailler is the name generally given to a low-tech mechanical device, similar to a typewriter, with the capability for direct output of embossed Braille onto paper.

![Fig 3.7 Example of a Notetaker with an 18 cell Braille display, 9 buttons of Braille dot based input, a speaker and audio jack for audio output](image)

The following video shows a demonstration of the BrailleNote computer.
The following video is a basic overview of the JAWS screen reader.
For a comparison of Notetakers versus laptop computers for the blind, please see http://nfb.org/legacy/bm/bm03/bm0304/bm030407.htm

For further information on Notetakers and Accessible PDAs please see http://www.myflorida.com/dbs/assistive-technology/notetakers.php

Device shown is a BrailleNote from HumanWare

3.2.2 Accessible media and formats

Students with vision impairments or print disabilities (i.e. cannot perceive written text) may require information to be made accessible in a variety of formats and ways:

- **Braille** - A tactile system using patterns of raised dots representing letters and numbers. Braille is produced using a special printer, called an embosser, but can also be produced using accessible PDAs (above) or by attaching refreshable Braille output devices to a standard computer.

- **Large print** – Printed text in which font sizes are typically increased to 16 points or larger, benefiting persons with mild vision impairment

- **Electronic formats including:**

  - **Word-processed documents** - Such as those produced by MS Word and OpenOffice Writer
  
  - **Talking books** – Either narrated by a human or converted automatically into synthesized speech (a Digital Talking Book). Free online service and downloadable services are available to convert text files into synthesized speech audio files in formats such as MP3.
  
  - **Accessible HTML** or **PDF**
  
  - **DAISY (Digital Accessible Information System) Digital Talking Book (DTB)** – a DAISY DTB can include audio (human or synthesized) speech, which can be navigated, and a synchronized text version of the book. Depending on its configuration, a DAISY DTD can be listened to on a computer or standalone audio player, rendered using a refreshable Braille display, read on screen or listened to with synchronized text displayed on screen.
3.2.3 Costs and trends in the use and provision of Braille

The development of educational content in any of the formats designed to assist the blind and vision-impaired requires needs assessment at the earliest stages of content development. While cost is a major consideration in resource-limited countries, no studies are available on the relative costs of production and consumption of content in different accessible formats. Each format has different cost implications. For example, Braille printers cost between USD 1,800 (for low volume) and USD 80,000 (for high volume models). Even though audio books and DAISY books can be produced at no cost using free software, the distribution of that content may require the student to have access to a laptop or specialized audio player such as a DAISY reader -- bringing a cost to the end user.

The following issues should be considered:

- What are the national policies and trends in relation to the use of Braille? Schoolchildren in developed countries, like the U.S. and the UK, are now thought to have lower Braille literacy as a result of using high-tech solutions such as screen readers coupled with accessible websites and documents. Their Braille literacy may be lower than among children in developing nations, like Indonesia and Botswana, where there are few alternatives to Braille.
- For a vision impaired student who has not received instruction in Braille, content in audio format may be preferable.
- The level of built-in accessibility features varies among the different formats. For example, the DAISY format has been specifically designed with the needs of print-disabled users in mind.
And content in HTML or PDF that conforms to the international standard for Web accessibility contains many more accessibility features than an electronic document produced using software such as MS Word or OpenOffice Writer.

- While many electronic formats can be produced for "free," more time and expertise is typically required to produce content in accessible HTML or PDF than in other electronic text formats.
- How will the content be distributed, and will the student be able to access it?
- Whatever the format provided, what is the potential to centralize its production, hence reducing costs?

Whatever the format used, it is imperative that the needs of the students are assessed through consultation with the students and their families or advocates. Several resources for the development, production and distribution of accessible electronic content in educational settings are provided in Section 9.

85 http://www.afb.org/ProdBrowseCatResults.asp?CatID=45
86 http://blindaccessjournal.com/?p=924
87 http://open.salon.com/blog/the_biblio_files/2010/02/02/listening_isnt_reading__why_braille_is_still_necessary
88 Numbers of blind children learning Braille in US down from 50 per cent in 1950s to 10 per cent today
89 http://blindaccessjournal.com/?p=924

3.2.4 Considerations when choosing a Braille printer

One of the principle pieces of Braille equipment used by schools and universities is a Braille printer. Translation software converts an electronic text file into Braille code -- either grade 1 or 2. Grade 2 Braille contains contractions of commonly used combinations of words and letters. The Braille printer uses Braille code to emboss the Braille dots onto the paper, which generally heavier than inkjet printer paper. Interpoint printers can emboss Braille on both sides of the paper.
Braille printers vary greatly in price. The main difference between printers is the volume of Braille they can produce. Quality Braille production also requires some level of training and knowledge of Braille, the translation software, and use of a Braille printer. So it may not be practical for all schools using Braille for their students to run and maintain a Braille printer. When choosing a Braille printer, considerations should include:

- **The need for Braille** – Establish the exact number of students needing Braille and the likely volumes for each student. These numbers are best derived through consultation with students and their families or advocates.
- **The volume of Braille likely to be produced** - Determine the volume of class texts that will be produced in Braille. An important consideration is that Braille production requires the original source document to be available in electronic text.
- **Lead-in time** – When is the Braille required, and can it be provided in time for students to keep pace with the class? In one Kenyan school, it takes four to six months for updated Braille versions of textbooks to arrive.\(^{90}\)
- **Specialist knowledge** – Braille is best produced by a trained Braille transcriber who is familiar with the translation software and the different grades of Braille, and who can provide some proofing of the embossed Braille.
- **Local or centralized production** - Consideration should be given to centralizing the production of Braille. An underutilized Braille printer may be available for use in another school or facility.
- **Location** – Braille printers vary in size but all are noisy, due to the mechanical nature of Braille embossing. Consideration should be given to where the printer will be housed.

**Costs** – It may be cheaper to run a larger Braille printer in a central location that will serve a number of schools than to run and maintain multiple smaller printers. Consideration should also be given to the cost of other high-tech solutions such as a screen reader.

See the case study from Kenya in which laptops and ATs for blind students were provided by an international aid organization and an AT vendor at a reduced rate to university students. The laptops and ATs were provided at a cost of USD 250, compared with USD 400 for a Brailler.

\(^{90}\) [http://www.yourdolphin.com/productdetail.asp?id=8?t=show&csid=50&z=5](http://www.yourdolphin.com/productdetail.asp?id=8?t=show&csid=50&z=5)
3.3 Deaf and hard of hearing

The World Health Organization (WHO) defines deafness as complete loss of the ability to hear from one or both ears. This is profound hearing impairment -- 81 dB or greater hearing threshold, averaged at frequencies 0.5, 1, 2, 4 kHz. The WHO defines hearing impairment as a complete or partial loss of the ability to hear from one or both ears. This represents mild or worse hearing impairment of a 26 dB or greater hearing threshold, averaged at frequencies 0.5, 1, 2, 4 kHz. Some 250 million people in the world are estimated as having a disabling hearing impairment.

The barriers encountered by children with a hearing impairment in inclusive schools relate primarily to communication.

Assistive technologies for hearing

The predominant AT used by people with a hearing impairment is a hearing aid. Hearing aids amplify sound from the surrounding environment, but may also be used to amplify signals produced by a T-loop system. A T-loop picks up audio from a microphone and transmits a signal within the area of a wire loop directly to a compatible hearing aid.

Alternative formats

Issues encountered by deaf people when using a computer to access electronic content relate primarily to audio. Captioning is the rendering of speech and other audible information in the written language of the audio. Captions can be closed, meaning that they are encoded and can be toggled on or off if the user's browser or media player can decode them. Or, they are open -- they are presented at the same time as the visual content. Captions are more sophisticated than subtitles, which are suited for hearing people who do not understand the language of the content. Captions may provide meta-information about who is speaking or the tone of the voice, and they can denote other sounds that occur on the sound-track of the content.

World Wide Web authors are becoming aware of the need to develop caption and file formats that accommodate a captioning track. Caption-authoring packages are available to add multimedia, overlay captioning to computer-based video. The online video-sharing website YouTube has introduced an automatic captioning service.
Text transcripts or captions for learning resources or training materials enable access to these materials by literate students with hearing impairments. Text captions also aid comprehension by students whose first language is that not that of the course material.

Many deaf people\textsuperscript{96} use sign language, which they may consider to be their first language. Sign language may also be used in audio/visual materials, with a sign language interpreter appearing in the bottom right corner of the screen to provide a sign language interpretation of the speech in the audio track.

The following video shows how the use of captions and audio descriptions are essential for both deaf and blind students in the use of educational materials.

\textsuperscript{91}World Health Organisation http://www.who.int/pbd/deafness/facts/en/

\textsuperscript{92}http://www.who.int/pbd/deafness/facts/en/

\textsuperscript{93}A T-loop is a wire fixed around a designated listening area connected to a power source, an amplifier and a microphone. The microphone picks up sound from the sound source (which may be a television, a bank official or an actor in a theatre) and carries the sound to the amplifier which, in turn, sends the
sound signal in the form of a current around the loop. A hearing aid user whose hearing aid has the 'T' facility, picks up the signal by moving a switch to the 'T' position. http://www.deafhear.ie/documents/pdf/04SG1207.pdf

94 WebAim article on “Software for creating captions” http://www.webaim.org/techniques/captions/software.php

95 Note: this service is still in beta (test) and has a low rate of accuracy http://www.google.com/support/youtube/bin/answer.py?answer=100077

96 Include note on deaf culture and Deaf with a capital “D”

3.4 Cognitive impairments

The “Disabled World” project proposes two main classifications of cognitive disabilities – namely, functional or clinical disability. Clinical categories of cognitive disabilities include autism and Down Syndrome. Less severe cognitive conditions include the sub-category of so-called learning disabilities, such as dyslexia (reading) and dyscalculia (mathematics). The functional disability perspective ignores the medical and behavioural causes of cognitive disabilities and focuses instead on the abilities and challenges the person with a cognitive disability faces. Functional cognitive disabilities may involve difficulties or deficits involving:

- Problem-solving,
- Attention,
- Memory,
- Math comprehension,
- Visual comprehension,
- Reading,
- Linguistic (speech), and
- Verbal comprehension.

It is somewhat more useful to consider the use of accessible ICTs to aid cognitive impairments from
the functional disability perspective. ICT can play a major role in enabling access to education for all types of cognitive impairments. The following list shows the benefits that access to ICTs can bring to people within the wide spectrum of learning disabilities. These include:

- **Improved writing** – Standard word processors contain built-in tools for checking grammar, spell-checking and predictive typing. Specialized writing support programs, such as Clicker 5, can aid word recognition and writing through the use of symbols or pictures and speech-supported grids.

- **Multimedia** - The use of multi-media such as graphics, sound and video can stimulate and encourage interaction and some degree of learning for people with more profound cognitive impairments, as well as for pre-literate children. Much of the software required to create multimedia is freely available online.

- **Sensory stimulation** - The use of switches, combined with specialized software games can enable some people with profound and multiple learning difficulties to play basic cause-and-effect games and even develop some basic computer interaction skills.

In addition to these computer-based activities, the use of augmentative and alternative communication strategies and devices, particularly those employing symbols, can aid communication for persons with more profound and multiple learning impairments.


98 http://www.bltt.org/index.htm Charlie Danger is a freelance technology assessor and occupational therapy (OT) student at Brighton University

99 MS Word or OpenOffice

100 http://www.cricksoft.com/uk/products/clicker/

### 3.5 Equipping inclusive schools with accessible ICTs

The clear position of the United Nations, UNESCO and the WSIS Plan of Action is that children with disabilities should be able to receive an inclusive education through the use of accessible ICTs. National policies should avoid the development of a two-tier educational system consisting of ‘normal’
schools and special schools for children with disabilities. Section 2 showed that funding models for special schools are likely to incur twice the costs of educating children in inclusive schools. Similarly, it was shown that the cost of including accessibility in the development of school buildings, software and equipment procurement can significantly reduce the overall costs of accommodating these requirements.

The budget required to equip inclusive schools with accessible ICTs should be established by education ministries and local education authorities in close consultation with students, their families and advocates and relevant disabled persons’ organizations. Careful research should be carried out to establish which ICTs are most required. Schools that accommodate the needs of their students with disabilities will likely have more need for Internet access. Economies associated with bulk purchasing should be realized through centralized procurement, using appropriate public procurement policies wherever possible. However, each school should be equipped according to the needs of that school’s children. Blanket provision of AT should be avoided in favour of each school defining its own requirements.

Within resource-limited countries, careful research and planning is required to help prioritize the main types of support and AT required. The main challenge is to “make products and services available, accessible and affordable”. Consideration should be given to reducing or waiving import duties and taxes on the ICTs required to enable persons with disabilities to access an equitable education. An AT ecosystem is needed to ensure that the infrastructure, personnel and products are available. Assessment and support services, such as installation, training and follow-up (to ensure safe and efficient use) are an important part of this ecosystem. The next section deals with the development and implementation of accessible ICTs within an inclusive school system, and the stakeholders and roles involved in the development of a sustainable AT ecosystem.

4 Developing and implementing accessible, ICT-connected schools

“Ensuring that children with disabilities enjoy opportunities for learning in an inclusive environment requires changes in attitude, backed by investment in teacher training and learning equipment”. Education for All Global Monitoring Report 2010102

The UN Convention on the Rights of Persons with Disabilities contains very specific guidance on the rights of persons with disabilities to enjoy equal access to education, job training and employment. The Convention places a particular emphasis on the provision of accessible ICTs as a key enabler to the enjoyment of these rights. Any policy to implement accessible ICTs in connected schools should be developed within the framework of the Convention, and should be based on the World Summit on the Information Society (WSIS) principles, actions and targets, with due regard to national and regional conditions.

In Section 1 and Section 2, inclusive education – the enrollment of children in mainstream classrooms - was shown to offer a cost-effective approach to reaching the large numbers of children with disabilities in developing countries. Inherent in inclusive education is the notion that reforms and improvements should not only focus on children with disabilities but on “whole-school improvement in order to remove barriers that prevent learning for all students.”103 This section outlines good practices in policy development for the introduction of accessible ICTs in connected schools. It provides principles and elements that can be incorporated into educational policy reforms in any developing country.

Inclusive education cannot be built and delivered all at one time.104 To develop sensible and practical policy that is properly embedded into the educational and assistive technology (AT) environment of a country, policy-makers must consider how to transition from their current model to an inclusive model. This will involve considering the development of a national-level statement of principles, intentions, means, objectives and timetables relating to the provision of accessible ICTS in inclusive schools. Evidence-based policy on the successful provision and use of ICTs will require identifying the gaps as they currently exist; research into the current landscape is critical.

102 http://www.unesco.org/en/efareport page 12
4.1 National policy reform

National “e-strategies,” framed within the WSIS Principles and Goals (Section 8), include policy areas such as connectivity, (e.g. broadband rollout), capacity building (e.g. training in use of ICTs for all sectors of society, including teachers and persons with disabilities), and education (provision of ICTs in schools). Policies and programmes in support of accessible ICTs in connected schools will therefore cut across several policy areas, including:

- Education,
- Telecommunications,
- E-government,
- Finance and public procurement,
- Import/customs duties and taxation,
- Welfare and employment, and
- Equality.

UNESCO’s Institute for Information Technology in Education (IITE) views policy development for the use of accessible ICTs in schools as a “complex proposition based on the principle that technology is not only a tool,” it also requires “a shift in the focus from technology provision to the design of learning environments.” Policy development has, therefore, moved from an exclusive focus on the provision of hardware and software to the effective use of ICTs in different educational contexts. UNESCO suggests four stages for the successful integration of accessible ICTs in an inclusive educational environment. This includes the design and development of the accessible ICTs, their implementation and improvement, and the assessment of their benefits (Fig 4.1)
Based on these four stages, UNESCO IITE provides a useful listing of policy activities that policymakers can undertake under each of these headings, plus a range of indicative sources of evidence and information for each.\textsuperscript{106} See Checklist for policy makers.


\textsuperscript{106}UNESCO IITE page 96-97

\textbf{4.1.1 Six key policy areas in developing and implementing accessible ICTs in connected schools}

In conjunction with the four stages of policy development, policy-makers should consider several key elements. Based on a study by the European Agency for Development in Special Needs Education,\textsuperscript{107} the following six elements are particularly important for national-level accessible ICT policies:

- **Infrastructure** – This includes statistics on connected schools with Internet access, the number of computers available in schools, the availability of assistive technologies, the use of computers and other forms of ICTs as pedagogical tools by teachers.

- **Availability of support** – Closely related to infrastructure, this looks at the range of support available to teachers and students from national agencies for ICT in education. This can
extend from support services that work directly with children and teachers, to in-school supports, to access to specialist resource centers.

- **Needs assessment** -- While needs assessment systems for children identified as having a disability may already be in place, they should incorporate a clear statement of needs that cover the ATs and related supports required to enable the child to receive an education in an inclusive school environment.

- **Training** – A key element of support is in training specific to the teaching of children with disabilities. A key element of that will be the use of accessible ICTs, which includes training during initial teacher orientation and in-service training. The availability of relevant support and training is often cited by teachers as an area of equal importance to the availability of appropriate hardware and software.

- **Co-operation/research** – A key element in building capacity within a country’s educational system is the development of a sustainable AT ecosystem. This includes ongoing research into the needs and experiences of both learners and teachers, sharing of experiences and expertise, and research into the development of new and better AT solutions and service-delivery models.

- **Evaluation** – Implementation of various policy reforms must be monitored to determine whether they will achieve their stated goals and to analyze and interpret the results and inform further policy intervention.


### 4.1.2 Research in support of evidenced-based policy development

Policy-makers will have to undertake a small number of research studies to support the development of effective policy. 108 Very little is known about the provision of ATs in developing countries at present, other than it is very low - only 3 per cent of the number of hearing aids required in any one year become available in that year. 109 It is likely that these research efforts will significantly improve the quality and effectiveness of policy measures.
Research into the attitudes of teachers, students and their families or care-givers toward the use and benefits of accessible ICTs will also be necessary. The pedagogical preferences and skills of teachers should be established. Research should also establish the competency of teachers and school systems to develop accessible learning resources and what training supports they may need.

The existence of relevant services already in place should also be established. These include the existence of community-based rehabilitation services, teacher training programmes, and facilities to produce low-tech solutions such as school books in Braille.\(^{110}\)

In order to develop evidence-based policy, research will be required on:

- National demographics on persons with disabilities – the numbers likely to benefit from accessible ICTs in schools/community ICT centers.
- Current ICT infrastructure within the schools, including the number of computers already in schools and the number of schools connected to the Internet.
- Current usage of ICTs in schools – i.e., how and for what computers are used.
- Types and numbers of accessible ICTs required.
- In-country availability of required accessible ICTs.
- Likely costs and strategies for development of alternate solutions, including open-source solutions.
- Preparedness of teachers to incorporate accessible ICTs into their pedagogical practices.
- Attitudes and knowledge of students, parents and teachers towards accessible ICTs.
- Availability of support networks.


4.1.3 Stakeholders and consultations

A range of organizations and stakeholders will be responsible for policy implementation. Overall responsibility will likely lie at the ministerial or regional government level, depending on the size and autonomy of regions. Stakeholders will include:

- National and regional educational authorities, from the ministry of education to regional educational authorities.
- School boards, principles, teachers and accessible ICT specialists and support staff.
- Private and public service providers, from Internet service providers to specialized assistive technology practitioners and vendors and mainstream ICT providers (local, national or multinationals).
- State or privately funded, not-for-profit disability service providers.
- Persons with disabilities, their families, care-givers and advocates.
- Disabled persons advocacy organizations.
- National and regional ministries and regulatory authorities in charge of ICT and telecommunication policy, strategy and regulation.
- International, national and regional telecommunication regulatory authorities.
- The scientific, research and academic community.
- International aid organizations and charities.

One of the primary aims of the UN Convention on the Rights of Persons with Disabilities is to place persons with disabilities at the center of relevant policy development. The ITU/G3ict e-Accessibility Policy Toolkit provides practical tips on conducting accessible meetings and conferences. The ITU/G3ict Toolkit also suggests that “representatives of persons with disabilities can facilitate the administration of surveys needed to obtain data about accessible ICT and assistive technology needs.” It is essential that the needs of children with disabilities, as well as the needs of their teachers, parents and care-givers are systematically gathered and taken into consideration at all stages of the development of policy on the use of accessible ICTs in connected schools.
4.1.4 Special policy considerations for persons with disabilities

While policy-development methodologies will vary from country to country and are dependent on the level (national, regional, local) at which they are developed, some special considerations should be taken into account when developing policies for persons with disabilities. The following considerations from the Centre for Internet and Society in India will help policy-makers to design policies that help persons with disabilities more effectively:

- Involving persons with disabilities and their care-givers or advocates is a key component of the entire policy-development process.
- Face-to-face consultations are important, particularly in areas where there is no existing access to the Internet or computers in schools.
- It is important to build capacity and awareness of the benefits of accessible ICTs for teachers, students and their parents and care-givers. Many persons with disabilities and their families may be unaware of their rights, or of the benefits of using accessible ICTs for education, job training and employment.
- The absence of a business case does not eliminate the need or the right to seek a policy on the use of accessible ICTs to enable inclusive education. While no figures are currently available on the return on investment in developing countries for the provision of accessible ICTs, research shows an overall positive cost benefit to countries of inclusive education.
- A mix of approaches should be considered toward incentivizing and obliging the adoption of new policy. For example, AT development companies could be given tax breaks, and educational systems could be obliged to meet certain targets.
- Policy-makers should not be reluctant to cooperate with disabled persons organizations in developing, promoting, implementing and monitoring implementation of policy.

4.1.5 Evaluation and monitoring

The policy framework should monitor and evaluate outcomes and the cost-effectiveness of the provision of accessible ICTs. The monitoring of outcomes should incorporate:

- Outcomes for the individual user – what improved level of access to education has been recorded; Most popular and successfully used types of AT;
- Experiences of teachers in incorporating the use of AT into the curriculum; and
- Level of AT abandonment, if any, and reasons for that abandonment.

The overall cost-benefit analysis of providing accessible ICTs to the inclusive educational agenda within a country should also refer to:

- Benefits and possibilities of accessible ICTs in enabling persons with disabilities to receive an education and to work in a variety of jobs and professions;
- Social justice and wide social inclusion goals, empowerment of persons with disabilities through education and job training;
- Reduction in poverty;
- Benefits to the economy;
- Ratification of conventions (UN CRPD and UNICEF);
- Meeting international policy goals (MDGs and WSIS); and
- Any relevant regional ICT initiatives.

See more on the wider costs of exclusion.

4.2 Supporting teachers and students

*If the real potential of ICT for pupils' learning is to be reached, teachers will first have to be convinced of the value of using ICT.*

Pre-service and in-service teacher-education programmes on accessible ICTs are essential if teachers are to attain the pedagogical capacity necessary to make accessible ICTs a viable option for mainstreaming children with disabilities in inclusive schools. The availability of appropriate support
structures for implementing accessible ICTs in an inclusive school setting has been stressed as being as important for many teachers as the provision of the appropriate hardware and software.\textsuperscript{113}

The UNESCO Institute for Information Technologies (IITE) provides an in-depth resource on the training of teachers in the use of accessible ICTs for Special Needs Education (SNE). This training comprises four modules covering (1) an overview of the place of accessible ICTs in SNE, (2) ATs for students with disabilities, (3) the use of ICTs in distance education for students with special educational needs and (4) the role of policy in the implementation of ICT in SNE.

\textbf{Figure 4.2 UNESCO IITE ICTs in Education for People with Special Needs}\textsuperscript{114}

While it is not necessary for teachers to have in-depth knowledge of assistive technologies and devices, it is important that they receive supported in developing educational material and resources that are accessible for all students.

Another key resource is the report \textquotedblleft A review of good practice in ICT and Special Educational Needs for Africa.\textquotedblright\ Commissioned by the Ghanaian Ministry of Education in 2003, this report contains suggestions for curriculum development, training of teachers and practical advice on such things as setting up a resource room for the use of ICTs.
Resources for teachers

The section on technical resources has a range of resources for teachers to become familiar with the use of ATs and accessible formats in the classroom curriculum. Those resources could be incorporated into both pre- and in-service training for teachers. Policy-makers should also consider supporting and funding the development of distance learning courses in the use of accessible ICTs in inclusive classrooms for in-service training of teachers.

One of the first things teachers should learn is about the accessibility features in technologies they already know and use. The Microsoft guide “Accessibility: A Guide for Educators” provides information about accessibility and accessible technology to help educators worldwide ensure that all students have equal access to learning with technology. The guide provides:

- Detailed guidance on using the accessibility features in Microsoft products,
- An understanding of accessibility and how it impacts the classroom,
- Definitions of impairment types and technology solutions for each type of impairment,
- Guidance on choosing accessible technology solutions, and
- Resources for more information.

Links to resources on using the accessibility features of other major operating systems such as Apple OS X and Linux are available on the e-Accessibility Policy Toolkit website.?

European Agency

European Agency


4.2.1 Integration and use of accessible ICTs in school curriculum

UNESCO defines curriculum as “what is learned and what is taught (context): how it is delivered (teaching – learning methods); how it is assessed (exams, for example); and the resources used (e.g.
books used to deliver and support teaching and learning).“\textsuperscript{115} Curriculum development and teaching practices have received much attention in the movement toward inclusive education. In general, curriculum in inclusive schools must be “flexible and adaptable, designed to reduce environmental barriers of students who may disadvantage [sic] from regular education.”\textsuperscript{116}

Accessible ICTs can help transform static curriculum resources into flexible digital media that students with a variety of abilities can access once they have the appropriate AT. For example, class notes developed in electronic text can be converted into a variety of formats such as audio, Braille, accessible HTML, DAISY audio book etc. Assessment methods need to be flexible and adaptable to students’ needs.

The introduction of any new ICT or AT should be complemented by sufficient technical support in order to reduce the stakes of abandonment. The mostly likely source of this ongoing support is through centers of specialized knowledge located within local or regional school networks.

It is important to differentiate between (a) the specialized support and training required by both students and teachers in the use of specific ATs in classroom settings and (b) the use of accessible ICTs generally to improve access to curriculum. For example, in the Kenyan case study, blind students were given specific training in the use of screen-reading technology before they were able to use the technology to access educational materials in the mainstream classroom.\textsuperscript{117} However, once this training was received, teachers were then required to provide learning materials in a format (electronic) that was compatible with the screen reader. Therefore, in line with the principles of Universal Design, national policies on curriculum development should require that learning resources, such as text books, be made available in alternate formats.

In general, a connected school that uses accessible ICTs to enable students with disabilities to receive an education in an inclusive environment will need to adopt the use of ICT in all areas of curriculum development. While it is beyond the scope of this toolkit to make specific recommendations on curriculum development, UNESCO identifies four key curriculum areas through which ICT skills and literacy can be improved. These are:

(i) **ICT literacy** – ICT skills are taught and learned as a separate subject.
(ii) **Application of ICTs in subject areas** – ICT skills are developed within separate subjects.
(iii) **Infusing ICTs into the entire curriculum** – ICTs are integrated or embedded across all
subjects of the curriculum.

(iv) **ICT specialization** – ICTs are taught and learned as an applied subject to train for a profession.\(^{118}\)

\(^{116}\) UNESCO IITE page 110

\(^{117}\) http://www.yourdolphin.com/productdetail.asp?id=8?t=show&csid=50&z=5


### 4.2.2 Assistive technology and needs assessment

As advised above, the procurement of assistive technology (AT) should be informed by research into the needs and requirement of individual schools and students. An effective needs assessment model will identify the appropriate AT to suit an individual user’s needs. (See section on technical resources for resources on needs assessment and AT). The *Assistive Technology Decision Tree* by UnumProvident provides a process by which to pick the correct choice of AT based on a person’s functional limitations.\(^{119}\)

Needs assessment should be carried out by qualified personnel with expertise in AT. The assessment may be carried out by a specialist visiting the school, in consultation with the child’s teacher, family and care-givers, or at an existing community rehabilitation facility. Once the needs assessment has identified the AT requirements of the student, these requirements should be formally communicated to the educational authorities. Whatever the funding strategies and level of AT provision by the school system, it is imperative that this clear statement of a child’s AT requirements be recognized and achieved over time.

Teachers, parents and children with disabilities need accurate information on the types and ranges of ATs available. Policy-makers should consider developing national databases on the types of ATs available, as well as lists of suppliers. This will also help identify gaps in the availability of certain ATs
in any given country.

http://www.microsoft.com/enable/download/default.aspx#righttech

4.3 Funding strategies

The provision of accessible ICTs and the introduction of support services, such as teacher training and student needs assessment, will require significant funding, which may present a challenge to some governments in developing countries. Key funding areas will include the provision of assistive technology (AT), related specialized support services for students, and teacher training.

4.3.1 Sustainable funding

One of the key research findings on ATs in developing countries is the need for a sustainable funding model. While the initial capital needed to provide the equipment and software is of course necessary, it is vital that consideration also be given to ongoing support and maintenance of this equipment. The following best practices are based on the case studies in this module; they point to a variety of funding strategies and partners. These partners include government (national and regional), educational authorities, private industry (local and international), and international aid organizations.

Provision of subsidized AT from AT vendors and charitable organizations

Several projects around the world provide computers and other ATs to schools and telecenters in developing countries, at a significantly reduced rate or for free. Charitable organizations and multinational companies provide heavily subsidized or free laptops and computers with ATs. In one project supported by Sight Savers International, 45 refurbished laptops, supplied by ComputerAid (the UK based PC recycling charity), and flash drives containing screen readers and magnifiers by Dolphin (the UK based assistive technology developer) were provided to blind students at Kenyatta University in Nairobi. At a cost of USD 250 for each laptop and flash drive, the prices “compare very well with Braille and Braille books.” See more on this in the case study from Kenya.
In comparison to this approach, the POETA project, based in Latin America and the Caribbean, works with local non-governmental organizations over a longer term to develop IT training centers that contain ATs and provide job-training skills to persons with disabilities (see POETA case study). This longer-term approach works to develop accessible IT training centers, with the ultimate of making them self-sustaining. One study of the POETA centers found that participants, at least anecdotally, were willing to pay a nominal fee to attend the courses.  

This study also found that while the cost of AT is a significant barrier to access for persons with disabilities in developing countries, it is critical that funding strategies go beyond “parachuting-in technology” and look to support projects that will empower persons with disabilities through long-term access to AT.  

This presents a significant challenge from the “corporate social responsibility” perspective, whereby funding and/or technology are often provided on a once-off basis. 

Therefore, whatever funding strategy is used to capitalize the initial provision of AT in connected schools, governments and educational authorities will need to be able to support students and teachers alike in the use of ATs, and in their incorporation into the inclusive curriculum of a school.  

120 http://www.yourdolphin.com/productdetail.asp?id=8?t=show&csid=50&z=5  

121 Technology and Social Change (TASCHA) group, University of Washington. Technology for employability in Latin America: Research with at-risk youth & people with disabilities  

122 TASCHA study page 86  

123 TASCHA study page 84
4.3.2 Proprietary and “free and open-source” software

Another important procurement consideration for policy-makers is the choice between proprietary or open-source software and AT. Proprietary software is developed and licensed by a private company, and is supplied on a for-profit basis. Typically, the software code cannot be reused or because of licensing arrangements. Open-source software allows the reuse and repurposing of code under certain licensing conditions such as the General Public License (GPL).

The “free” in “free and open-source” software refers to the freedom to modify computer code -- not necessarily the availability of software for free. Many open source software products are available free of charge, but governments or schools may have to incur a cost for this software to be developed into a service or solution that meets their needs. For example, an organization using an open-source content management system (CMS) may need to pay a web developer to develop the website using that CMS. So while the source code of the CMS is available free of charge, the organization may have to pay for a specialist to develop and perhaps maintain the website. Similarly, a school system that chooses to supply open-source ATs to its students may need to pay for services such as teacher and staff training in the use of the ATs, as well as support for maintaining and upgrading them.

While some of the case studies (Kenya) show that schools and universities can and do benefit from donations of proprietary software and ATs by companies and charitable organizations, the total demand for ATs required in-country is unlikely to be met through this supply model alone. On the other hand, the supply and use of open-source solutions requires a level of in-country expertise for installation, training and support. This also has cost implications. So policy-makers should consider which approach will work in the short, medium and long term. Whatever the model or mix of models chosen, it will be necessary to support ongoing research and development into new AT solutions at university and industry levels. One key issue for research and development is the need to provide ATs in the local language of each country.

See Section 5 for more on funding models derived from research into accessible telecenters.

4.3.3 Supporting a sustainable and viable AT eco-system

In order for persons with disabilities to access appropriate assistive technology (AT), there must be a vibrant and sustainable AT ecosystem. Key components of such an AT eco-system include:

- An AT industry that provides affordable and usable AT equipment to users;
- An AT assessment, delivery and support system that is part of existing community-based rehabilitation services -- and that links in with the local school system to provide support to teachers and students;
- A research community to explore the effectiveness of current AT delivery systems, the development of new and improved ATs, and the potential of new technological developments; and
- Government funding and support for AT.

Developing countries have the opportunity to learn from the experiences of developed countries which, in spite of relatively high levels of resources, still struggle in many cases to meet the AT needs of persons with disabilities.

Research in Europe has shown that many AT companies develop as the result of a small, local demand.\textsuperscript{125} For example, the first line of Siemens Hearing Instruments was initially meant for employees of that company and their family members. Thus, small AT companies develop based on solving a need locally, and often do not have a business plan for rapid scalability.

A further issue is market fragmentation. Research supported by the European Commission has found that “the degree of fragmentation for AT ICT in general is high, driven largely by the unique, national-level or regional-level service delivery systems that minimize the ability for companies to realize significant economies of scale.” The fragmentation caused by different national systems and policies makes an already limited market for accessibility products even smaller. A further issue is that the type of solution required may vary from country to country – according to different languages, for example. The result of this fragmentation in the AT industry in Europe is that:

- End-users have reduced choices of solutions;
- Companies have a reduced market size, which impacts sales and profits; and
The solutions may suffer from poor design, reliability and robustness, due to a lack of ongoing research and development.

Market fragmentation is not only an issue for the viability and future development of a robust and profitable AT industry, it impacts on the choice, quality and affordability of solutions available to end-users within a region.

One solution being proffered in the European context is the development of an organization to represent and support the AT ICT industry through networking between stakeholders, including end-users and service providers such as educational authorities. These partners would exchange knowledge on marketing and technical information. Policy-makers in developing countries may wish to encourage such networks to foster development of an in-country AT industry. The network could be developed at a national level or as part of an international network between countries.

Examples of industry associations for AT include:

- AAATE, Association of the Advancement of Assistive Technology in Europe
- ARATA, Australian Rehabilitation and Assistive Technology Association
- RESJ RESNA, Rehabilitation Engineering and Assistive Technology Society of North America
- Rehabilitation Engineering Society of Japan


### 4.4 Procurement policies

Public procurement has long been used by many governments to achieve social inclusion goals. National public procurement policy has the potential to positively influence the availability, affordability and quality of AT and other accessible ICTs such as Braille, DAISY books and accessible websites.

Public procurement provides educational and school authorities with a means to incorporate accessibility requirements at the earliest stages of developing a school IT infrastructure. This also has an impact on the wider accessible ICT eco-system by creating a demand, and therefore a capacity within the market, to develop, produce and maintain accessible ICTs. The greater the demand, the
lower the end cost is likely to be. Public procurement policy can, therefore, act as a means to promote
the development and availability of accessible ICTs.

Educational authorities could, for example, include accessibility as a criterion in the purchase of all
educational software, such as teaching programs or content management systems. This would help
ensure that all users, including persons with disabilities, would be able to use and access content from
the start, avoiding costly provision of specialized learning resources for these students at a later date.

Accessible ICT procurement toolkits have been developed in a number of countries to systematically
promote the procurement of accessible ICTs. A procurement toolkit typically provides guidance in the
development and assessment of tenders issued by public bodies for ICTs such as websites or
computers. Policy-makers could consider the development of a public procurement toolkit to
complement a national policy on the provision of accessible ICTs in connected schools. In this way,
any expenditure on ICTs for schools will ensure that the stock of school ICT hardware and software will
become more accessible over time. While this will promote the accessibility of the mainstream ICT
equipment used in schools, it will also be necessary to make a separate investment in specialized
solutions and assistive technology for children with disabilities.

For more on the role of public procurement in fostering accessible ICTs see the ITU/G3ict e-
Accessibility Toolkit.

\[126\]

Waddell, Cynthia. Meeting information and communications technology access and service needs
for people with disabilities: Major issues for development and implementation of successful policies and
strategies. Available at [http://www.itu.int/ITU-D/sis/PwDs/Seminars/Zambia/Documents/Presentations/
accessible ICTs, manufacturers respond by producing only accessible ICTs. It is simply too expensive
for manufacturers to produce two lines, one for the government and another for the public. Public
procurement requirements in countries that are major producers of ICTs has resulted in more
accessible features being included in mainstream ICTs.
4.4.1 Compatibility with school IT infrastructure

It is also necessary for AT to be compatible with -- and to be supported by -- schools’ ICT infrastructure. The list of questions in Table 4.1 will assist in reviewing the current or planned ICT infrastructure in the school to support ATs.

Table 4.1 Platform/infrastructure considerations in support of AT

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware – Platform</td>
<td>How will the platform support a range of third party input and output devices?</td>
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<tr>
<td></td>
<td>What connectivity to third party input/output devices will be available?</td>
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<td></td>
<td>Is the hardware compatible with widely used access software solutions?</td>
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<td></td>
<td>Will drivers for input/output devices be available on this platform?</td>
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<tr>
<td></td>
<td>What support can be provided for input/output based on legacy connections?</td>
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<tr>
<td>Hardware – Laptops</td>
<td>What range of screen size will be available?</td>
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<tr>
<td></td>
<td>How much do any specified portable devices weigh?</td>
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<tr>
<td></td>
<td>Are ruggedized devices available?</td>
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<tr>
<td></td>
<td>How do the devices open and start up – Ease of use?</td>
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<tr>
<td></td>
<td>What is the battery life: In hibernate? In continuous use?</td>
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<tr>
<td></td>
<td>Can the selected device accommodate peripherals such as scanners, CCTV/magnifiers, joysticks?</td>
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<tr>
<td>Managed Services</td>
<td>How will local specialist technician knowledge integrate with provider services?</td>
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<td></td>
<td>What provision of instant replacement services is applicable to users with individual needs?</td>
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<td></td>
<td>Can the systems be accessed by users of non-standard technologies?</td>
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<tr>
<td></td>
<td>Will users have access to the control panel features?</td>
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<tr>
<td></td>
<td>Can user profiles for accessibility features be accessed at login anytime anywhere?</td>
</tr>
<tr>
<td>Category</td>
<td>Question</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Operating System</td>
<td>What accessibility options are available in the operating system?</td>
</tr>
<tr>
<td></td>
<td>What are the timescales and related dependencies for approval and installation of access technologies?</td>
</tr>
<tr>
<td></td>
<td>What third party access software is available?</td>
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<tr>
<td></td>
<td>How will non-keyboard or non-literate users log on to the system?</td>
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<tr>
<td>Applications</td>
<td>What range of applications and software will run on the system, and will those options work with assistive technologies?</td>
</tr>
<tr>
<td>Intranet/Software as a Service (SaaS)</td>
<td>Will the applications comply with accessibility standards?</td>
</tr>
<tr>
<td></td>
<td>How will any bundled content created be managed? - How will the accessibility of content be assured?</td>
</tr>
<tr>
<td></td>
<td>Can it be accessed by users of non-standard technologies?</td>
</tr>
<tr>
<td>Assistive Technology</td>
<td>Can AT solutions be managed across the network?</td>
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<tr>
<td></td>
<td>Is network licensing of assistive technologies appropriate?</td>
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<td></td>
<td>How will ATs be maintained in line with operating system (OS) and application upgrades?</td>
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<tr>
<td></td>
<td>How will people with special needs access any online applications/ workstations/laptops/mobile devices?</td>
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<td></td>
<td>How will ATs be funded annually for new users and as users' needs change?</td>
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<tr>
<td></td>
<td>Are drivers for assistive technologies preloaded onto the system?</td>
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<tr>
<td>Building Design and Furniture</td>
<td>Are suitable power sockets and network access points available to support pupils throughout the building and immediate environment?</td>
</tr>
<tr>
<td></td>
<td>Is furniture accessible and suitably adjustable for individual needs?</td>
</tr>
<tr>
<td></td>
<td>Is technology sited for ease of access?</td>
</tr>
<tr>
<td></td>
<td>Does lighting reflect on the screen or create undue glare?</td>
</tr>
<tr>
<td></td>
<td>Can it be locally adjusted (e.g. turned off.)?</td>
</tr>
<tr>
<td></td>
<td>Is there sufficient space allowed in the classroom for equipment to be maneuvered and to promote access for people with limited mobility?</td>
</tr>
</tbody>
</table>

Source: ITU/G3ict e-Accessibility Toolkit
4.5 Trends in Technology development influencing the use of ICT in education

This section provides a brief overview of some main trends and developments in the area of assistive technology (AT) and the use of ICTs in education. It aims to inform policy-makers on which technology trends and developments should be considered in terms of research and development and international cooperation. While some of these may not currently be viable solutions for the use of accessible ICTs in schools in developing countries, they point to trends and developments that may ultimately address issues of affordability and availability of both AT and accessible educational resources.

4.5.1 Cloud computing and AT

Cloud computing is a current technological paradigm shift in which computing resources such as software are distributed over the Internet and made available to computers and other devices on-demand.\textsuperscript{127} The implication here is that AT software applications would not be installed on a particular machine, but rather would be accessed through the Internet from any computer. Preliminary approaches, such as online screen-readers, have "yielded promising results towards an inclusive Web by removing both economical and accessibility barriers."\textsuperscript{128}

More ambitious approaches, such as the Raising the Floor (RtF)\textsuperscript{129} and the LUCY project,\textsuperscript{130} aim to develop the tools and infrastructure necessary for persons with disabilities to have access to affordable ATs from any computer. Of particular relevance here is the RtF focus on the provision of ATs that are affordable. The RtF project recognizes that the "cost of commercial assistive technologies that are good enough to handle today's modern Web pages and applications far exceed the cost that those in lower socioeconomic situations can afford."\textsuperscript{131}

Unlike mainstream technologies, ATs such as screen readers have not tended to decrease in price over time. Instead, AT developers struggle to keep pace with developments in the interfaces and functionality of mainstream technologies. Open, collaborative projects such as RtF invite governments and research communities in universities and industry to contribute to their areas of activity.
4.5.2 Mobile learning

Lack of access to a computer in developing countries restricts many people’s access to the Internet. Mobile phone ownership is far greater in developing countries than PC ownership. For example, according to a report from the Telecom Regulatory Authority of India, approximately 5 million new mobile subscribers joined the ever-growing population of mobile phone users every month in 2006. Content delivered via mobile phone is being used for a variety of applications, including education. Mobile learning, or “m-learning,” is an array of e-learning over mobile devices such as mobile phones, which is of potential benefit to users in developing countries, especially those living in remote rural locations.

The challenges of providing content on a mobile phone include “how to efficiently render visual Internet content into short, precise, easily navigable, meaningful and pleasant to listen to audio content.” Still, the penetration of mobile phones in developing countries does present a potential opportunity for reaching more people than the current provision of content to desktop computers. Any country developing policy or initiatives to promote the provision of services over mobile phone networks should consider the implications for persons with disabilities, for example, using accessible books stored on mobile phones.

See proceedings from the ITU/UNESCAP/G3ict Asia-Pacific Regional Forum on Mainstreaming ICT Accessibility for Persons with Disabilities (Bangkok, 2009) on access to the internet for persons with
disabilities via mobile phone and the use of mobile phones for children with disabilities.

132 Nokia India. Position Paper – Mobile Internet UX for Developing Countries
http://research.nokia.com/files/Joshi-MIUXforDevelopingCountries.pdf

133 http://www.internetspeech.com/rendering_whitepaper.htm

4.5.3 Connectivity

Connecting all primary, secondary and post-secondary schools to ICTs by 2015 was one of the targets set by world leaders at the World Summit on the Information Society (WSIS). The lack of fixed-line telecommunication infrastructure has been an obstacle to accessing the Internet in many under-served and remote parts of the developing world. The increasing levels of connectivity to the Internet through wireless broadband -- a growing trend in developing countries -- promises to improve Internet connectivity in developing countries, including in schools. For students with disabilities, the possibility of accessing educational content online will significantly improve their ability to participate in mainstream education.

4.5.4 Learning platforms

Learning platform is a generic term used to describe a broad range of ICT systems that are used to deliver and support learning. These include Virtual Learning Environments (VLEs), which combine several functions such as delivering course work over the Web or an intranet to students or allowing students and teachers to interact. VLEs are regularly used for ‘blended learning’ that supplements traditional, face-to-face classroom activities. VLEs are most often used in higher (second or third level) education. Some VLEs are capable of producing content that conforms with the Web Content Accessibility Guidelines from the Web Accessibility Initiative (WAI). One such open-source VLE is Moodle.

134 W3C WAI, 2008. Web Content Accessibility Guidelines version 2.0. Available at http://www.w3.org/TR/WCAG20/
4.5.5 Open Educational Resources

Open Educational Resources (OERs) are learning materials that are freely available for use, repurposing and redistribution. The term was first adopted at UNESCO’s 2002 Forum on the Impact of Open Courseware for Higher Education in Developing Countries. While many OERs are available over the Web, many are not accessible to persons with disabilities. Policy considerations in this area could include international cooperation with other countries, establishing projects to develop OERs that are accessible to persons with disabilities, or developing strategies to systematically provide existing OERs in accessible formats.

An example of one such project is the “FLOE” or Flexible Learning for Open Education project, which received funding approval from the William and Flora Hewlett Foundation in 2010. The FLOE project will work with current OER projects and the accessibility community to develop a system that will better match OERs with the needs of learners. Current OER projects will be supported to produce more accessible OERs. Where learners’ needs are not being met, the FLOE project will work with the community of alternate format providers to develop accessible versions of OERs. Led by the Inclusive Design Research Centre at the Ontario College of Art And Design, the project will include a range of developing country partners such as:

1. OER Africa,
2. Strathmore University, Kenya,
3. University of Capetown, South Africa. and
4. Research Institute for Technology and Innovation (IPTI), Brazil.

To support adoption in Africa and other areas where mobile devices are more prevalent than Internet access, FLOE will create the tools and services needed to deliver OER via audio-only, text messages and small screens found on popular cell phones.
For further information on the potential of OERs as a tool for inclusive education, see the article “Access to Education with Online Learning and Open Education Resources: Can they Close the Gap?"\(^{140}\)

For a discussion on making online educational resources accessible, see the article “Accessible Distance Education 101."\(^{141}\)

\(^{136}\)http://en.wikipedia.org/wiki/Open_educational_resources

\(^{137}\)http://www.hewlett.org/

\(^{138}\)http://idrc.ocad.ca/

\(^{139}\)http://www.oerafrica.org/

\(^{140}\)Geith, Christine. Access to Education with Online Learning and Open Education Resources: Can they Close the Gap http://www.distanceetdroitaleducation.org/contents/FJALN_v12n1_Geith.pdf


4.5.6 Web accessibility

For some time now, a key policy consideration for public agencies in developed countries has been the accessibility of private and public websites.\(^{142}\) In accordance with the principles of Universal Design, incorporating the needs of persons with disabilities into the design and development of a website at the earliest stages is likely to incur little or no additional cost. Websites that are currently inaccessible are typically more difficult and expensive to retrofit.

The World Wide Web Consortium (W3C) Web Accessibility Initiative (WAI)\(^{143}\) has produced internationally recognized guidelines and resources for the development of accessible websites. Many countries now use the Web Content Accessibility Guidelines, version 1 or 2, as the standard to which
all public administration websites must conform. Policy-makers should consider imposing targets on publicly funded institutions, such as schools and universities --, and even private companies -- for the development of new websites and the retrofitting of old websites to conform to these standards.

A report on “Web Accessibility Policy Making: An International Perspective” showing a range of policy approaches to Web accessibility is available from the G3ict website.

142 http://www.e-accessibilitytoolkit.org/toolkit/developing_policy/
Step 4: Policy examples from around the world

143 http://www.w3.org/WAI/
?

5 Leveraging Accessible ICT-enabled schools as community hubs for training for Adults with Disabilities

“At the [accessible ICT center] we learn that because you have a disability you don’t have to be on the side, in a corner like a piece of furniture. On the contrary, you struggle for your life, these classes are an incentive to get ahead, to believe in yourself, to feel capable, that you can do the things that you want, the goals that you make.” Ecuadorian person with a motor impairment, participant in a POETA supported ICT centre

This section explores the potential of leveraging connected schools, equipped with Assistive Technology, as training centers for persons with disabilities within the community. It is based on the International Telecommunication Union’s (ITU) experiences in supporting Multipurpose Telecommunication Centers (MTCs), coupled with learning from international studies on the use of accessible telecenters and Technical and Vocational Education Training (TVET) centers in providing technical skills and job-preparedness training to persons with disabilities.

While equipping connected schools with assistive technology (AT) is a worthy goal in and of itself, the benefits can be multiplied by taking advantage of already installed ATs and computer equipment, as well as the administrative and management structures of the school to provide services to the broader community. Two potential uses can be considered. The first encompasses the well-established notion
of providing Internet access and ICTs through community-based telecenters. The second considers the possibility of literacy, numeracy, basic ICT skills and vocational job skills training.

144 Technology and Social Change (TASCHA) group, University of Washington. Technology for employability in Latin America: Research with at-risk youth & people with disabilities

5.1 Multipurpose Community Telecenters

Multipurpose Community Telecenters (MCTs) are promoted and supported by the International Telecommunication Union (ITU) as a means to facilitate universal access to telecommunication services -- particularly access to the internet via ICTs.145 This, in turn, enables people to become active participants in the emerging Information Society. MCTs are a shared facility for access to ICTs, along with user support and training. MCTs can reduce access costs larger numbers of people than the provision of individual solutions, such as laptops. MCTs also promote awareness of the potential benefits of the Information Society and “connectedness.”146

See the UNESCO reference document “Accessibility Guidelines for Community Multimedia Centres for People with Disabilities” that contains detailed guidelines, checklists and case studies on how MCT can be made accessible.

145 ITU http://www.itu.int/ITU-D/univ_access/telecentres/
Multipurpose community telecentres: Lessons Learnt http://www.itu.int/net/itunews/issues/2010/05/30.aspx

Skill training enhances productivity and sustains competitiveness in the global economy. Technical and Vocational Education and Training (TVET) is not just a means of preparing young people for the world of work, it is also a “means of reaching out to the marginalized and excluded groups to engage them in income-generating livelihoods.” The first of the Millennium Development Goals is to eradicate extreme poverty and hunger, with a target of halving, between 1990 and 2015, the proportion of people whose income is less than 1 USD a day and who suffer from hunger. Ensuring that workers have the skills to earn a livelihood through equitable access to appropriate learning is one of the six Education for All (EfA) goals established at the World Education Forum in Dakar in 2000.

TVET for poverty alleviation has become a priority for many governments in developing countries. The success and future expansion of TVET programmes in developing countries depends on the continued expansion of existing training programmes and continued cooperation among national and international bodies.

Many developing countries have concentrated on “universal primary education and literacy, but do not pay sufficient attention to skill training for youths and adults.” However, in countries such as Nigeria, there are “numerous initiatives focusing on providing education and training people from marginalized groups.” These are often small in scale and are not recognized as part of a comprehensive national educational strategy. The best practices referred to in this section recommend that TVET for persons with disabilities should:

- Provide qualifications that are part of the educational qualifications framework of the country;
- Provide certification that is valued by employers;
- Act as a bridge to return to further, more formal education, should the person wish to; and
- Take into account the low levels of literacy, numeracy and ICT skills among persons with disabilities, and recognize that previous educational experiences may have been negative.

One of the primary aims of the UN CRPD is for persons with disabilities to become active members of the workforce at all levels of industry, commerce, administration, governance and education.
Accessible ICTs hold the potential to enable persons with disabilities to receive job skills that would otherwise be inaccessible to them. For example, assistive technologies can enable access to mainstream office applications commonly used for business management and administration. Traditionally, persons with a disability such as blindness were often given specific and somewhat limiting roles within an organization, such as answering telephones as a receptionist. However, when sufficient and appropriate training is provided, persons with disabilities can reach their own personal potential once they have support and the required accommodations.

The case studies show a variety of job opportunities that persons with disabilities in developing countries are enjoying as a result of vocational training in the use of accessible ICTs. One growth area in jobs for person with disabilities in developing countries is employment at telecenters. The Microsoft website also illustrates a variety of ICT-specific careers made possible through the use of accessible ICTs.

5.2 Best practices and challenges in developing and sustaining accessible MCTs and Technical and Vocational Education Training (TVET) centers

Key considerations and good-practice guidance in this section are based on findings and recommendations of the 2009 study by the Technology and Social Change (TASCHA) group at the

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147 Bharat, *The Role Open and Distance Learning in Vocational Education and Training in India*

Published in *African Research Review - AFRREV*, January 2008, Volume 2, No. 1


150 [http://www.telecentre.org/group/telecentrefordisabilities](http://www.telecentre.org/group/telecentrefordisabilities)
University of Washington. “Technology for employability in Latin America: Research with at-risk youth & people with disabilities” looked at recent investments in technology centers to provide basic computer training for persons with disabilities in five countries: Brazil, Ecuador, Guatemala, Mexico and Venezuela.¹⁵¹


5.2.1 Funding models for using accessible, connected schools as MCTs and TVET centers

In the TASCHA study, a mix of funding models were observed in different countries, although all projects examined were part of the POETA programme of international aid (see POETA case study for more details). In line with the POETA policy of collaborating with local partners, funding was also received from municipal and national governments. In the context of the five countries examined in the study,¹⁵² there was no trend observed that participants were unwilling or unable to pay a "nominal amount" for access to ICT and job skills training.

The biggest barrier for functional access to technology was found to be the prohibitively high cost of AT software. For example, in the case study from Mexico city, AT such as a JAWS screen reader and MAGic were only provided in demo versions, requiring the user to reboot the machine every 40 minutes. While a number of projects are under way to develop ATs such as screen readers in underserved languages, these are currently insufficient to meet the worldwide need for the localization of these technologies. (See ITU and UN ESCAP Bangkok conference proceedings on “Mainstreaming ICT Accessibility for persons with Disabilities”). The TASCHA study concludes that the development of affordable ATs – screen readers- in local languages should be “a defining agenda for research and practice in technology in the developing world”¹⁵³.

Some aid organizations and technology companies worldwide offer subsidized versions of proprietary software (see case study from Kenya). The TASCHA studies conclude that such a model is unsustainable and that efforts should focus on building the capacity nationally and internationally to
produce affordable and localized AT.\textsuperscript{154}

\textsuperscript{152}Brazil, Ecuador, Guatemala, Mexico and Venezuela

\textsuperscript{153}TASCHA page 80

\textsuperscript{154}TASCHA page 80

5.2.2 Sustainable funding models and trends in the philanthropic approach

Funding for accessible MCTs should go beyond “parachuting in” technology and look at a sustainable business model for the center. The TASCHA report found that after the initial capital injection to buy AT and pay for training was finished, many telecenters found it difficult to become self-sufficient. While corporate social responsibility can potentially be utilized to secure an initial capital investment from a company or foundation, the TASCHA report warns that this funding model on its own is at odds with the “kind of investment need for meaningful support of human development initiatives such as [the development of accessible MCTs],”\textsuperscript{155} POETA points to trends in the philanthropic approach to providing aid to developing countries. Donating organizations have become more focused on the results of the investment. They play the role of a broker by providing a mix of funds, knowledge and expertise and requiring that projects are \textbf{replicable, sustainable} and have \textbf{appreciable results}.\textsuperscript{156}

In the context of accessible MCTs based in schools, consideration should be given to the sustainability of the business model. While much of the infrastructure, such as the school building and computer room, can be made available at no cost to the community, careful planning is required for funding ongoing ancillary services such as hiring trainers and providing job skills training.

\textsuperscript{155}TASCHA page 85.

\textsuperscript{156}POETA - presentation on file
5.2.3 Certification and ongoing education

Providing certification for course completion attracts participants and is a qualification desired by employers. The types of certification identified in the TASCHA study varied from project to project and were either provided by the telecenters, the local or national educational ministry, or by private companies such as CISCO and Microsoft.

Accessible MCTs based in schools are ideally placed to support cross-over programs for participants to complete formal education. The TASCHA study points out that TVET, and in particular ICT initiatives, serve as a ‘substitute’ for formal education. The following quotation for one respondent captures this potential which should be considered in context of policy development in support of accessible ICT schools:

“I didn’t hope to go to college before I took this course. I only started intending to head to college in this area due to this course. I liked computers, and it seemed like this course ‘fell from the sky’ for me, and I got the idea of going to college to study informatics after going to this course…it changed my thinking, informatics changed it a lot.”

–17 year old Brazilian youth

157 TASCHA page 56

5.3 Technology considerations

The TASCHA report found that one of the biggest barriers to functional accessibility among respondents was the lack of low-cost AT in the local language (Spanish). The report recommended that:

- The development of AT in local languages be promoted and supported by funding organizations of accessible MCT projects;
- Center staff be encouraged to develop low-cost solutions, particularly for adaptive equipment such as input devices, or workstation adaptations to help overcome common accessibility barriers;
Large technology companies be encouraged to develop their products according to the principles of Universal Design, making mainstream products both accessible and usable to widest range of users.

The TASCHA study identified a disconnect between the AT available in the telecenters and those made available by employers to enable a person with a disability to carry out their job.

5.3.1 AT for employment and job placement services for employers and participants

While some financial support was available from regional and national authorities to subsidize the ATs in the telecenters, no such subsidies were available in some countries to procure the same software and hardware once a person had secured a job placement. Accessible MCTs in schools providing training for persons with disabilities should foster strong relationships with local employers. In the case study on the Tunisian telecenter, the telecenter invited prospective employers to give presentations and evaluate student projects. As well as awareness-raising activities for employers, the accessible MCTs in schools could potentially provide some level of support in placing graduates in jobs. It could also support employers by identifying workplace accommodations and helping find appropriate AT.

Job placement support enables prospective employers to overcome negative perceptions about employing a person with a disability, as well as providing advice and practical support on making workplace adjustments. Workplace adjustments can include the sourcing and installation of ATs required to enable the person to work. It is key to facilitating the transition of the person from education and training to employment.

In Italy, for example, at the Politecnico di Milano, graduates with disabilities have reached a 100 per cent success rate in finding jobs, in part due to the outreach and ongoing support provided by the university to graduates and employers in making these workplace adjustments.\textsuperscript{158} The TASCHA report suggests that accessible ICT centers can “build a reputation for providing successful candidates by maintaining ongoing relationships [with employers]”\textsuperscript{159}.

A key policy consideration, therefore, is the provision of subsidies and grants to either employees or employers to make workplace accommodations, in line with the UN Convention’s obligations under “reasonable accommodation.”
There was a high demand from participants interviewed in the TASCHA study for additional and complementary employment services to be provided along with the ICT technical skills. These skills include resume-building, interview skills and other job-preparedness skills. In particular, respondents in the TASCHA study spoke of the increase in self-esteem and their personal perceptions of their own employability resulting from these ‘softer skills’ being part of the course.

Some of the telecenters in the TASCHA study also offered additional services such as physical rehabilitation and occupational therapy. In the context of schools providing access to accessible ICTs, close links with other established rehabilitative services in the community can be vital to developing and supporting the local ecosystem of disability services.

[Sbatella, Licia. 2010. *Higher education ICT programs for promoting employability of students with disability.*]

**6 Checklist for policy-makers**

The following is a review and checklist of the concepts and recommendations put forward in this module:

1. Policies for the implementation of accessible ICTs in connected schools should be developed together with disabled persons’ organizations and within the framework of international law and policy that includes the UN Convention on the Rights of Persons with Disabilities and the World Summit on the Information Society principles, actions and targets.

2. Policy development and implementation of accessible ICTs in connected schools should be used to further the inclusive educational policies of a country -- that is, education provided within the context of the mainstream educational system and not in a segregated setting.

3. Because inclusive education is a model that must be progressively realized, policy-makers should consider the development of national-level statements on the principles, intentions,
means, objectives and timeframes for implementing accessible ICTs in connected schools. Policy development on the use of accessible ICTs in inclusive schools will cut across several areas of governmental responsibility including:

• Education
• Telecommunications/ICTs
• E-government
• Finance and public procurement
• Customs/import duties and taxation
• Welfare and employment
• Equality

4. Four key stages in the implementation of accessible ICTs in inclusive education are:

• Design and development of accessible ICTs,
• Their implementation and delivery,
• Improvement, and
• Assessment of their benefits.

5. Six key areas for policy development include:

• Infrastructure,
• Support for practice,
• Needs assessment for persons with disabilities,
• Training for students and teachers,
• Co-operation and research on best practices, and
• Evaluation on the benefits and uses of ATs.

6. Research activities to support evidence based policy development should focus on establishing:

• Societal attitudes towards persons with disabilities and their inclusion as equal participants in the educational system;
• Attitudes of children with disabilities and their teachers, parents and car-givers on the use and benefits of assistive technology;
• National demographics on persons with disabilities, including the numbers of people likely to
  benefit from accessible ICTs in schools/Multipurpose Community Telecenters;
• Current ICT infrastructure within the school, including the number of computers already in
  schools and the number of schools connected to the internet;
• Current usage of ICTs in schools – how and for what;
• Types and numbers of accessible ICTs required;
• In-country availability of required accessible ICTs;
• Likely costs and strategies for development of alternate solutions, including open-source
  solutions;
• Preparedness of teachers to incorporate accessible ICTs into their teaching practices;
• Attitudes and knowledge of students, parents and teachers towards accessible ICTs; and
• Availability of support networks.

7. Policy implementation will require the cooperation of a wide range of stakeholders, including
  persons with disabilities, educational authorities and international aid organizations.

8. All consultation meetings on policy development held with persons with disabilities should be
done in an accessible manner.

9. The policy development framework for the provision of accessible ICTs in connected schools
should include a mechanism for evaluation and monitoring of outcomes. This should include
metrics on

• Levels of access by persons with disabilities to education and experiences of teachers and
  students in using accessible ICTs in the classroom,
• Levels of AT abandonment, if any, and reasons for abandonment ,and
• Costs of AT and learning resources in accessible formats.

10. Funding options for investment in an AT infrastructure for connected schools include
government funding and subsidies, public-private partnerships, partnerships with international
aid organizations and corporate social responsibility programmes from technology companies. A
key policy consideration for government and school investment in accessible technology is the
choice between open-source and proprietary models of software licensing. Policy-makers should
consider the implications of the choice of investment in terms of the likely short, medium and
long-term impacts on the availability and affordability of ATs.
11. Government investment policy in ATs for connected schools should look beyond just the provision of technology and aim to develop and support a sustainable AT infrastructure that provides for needs assessment, supply, maintenance, training and support in the use of ATs for both students and their teachers.

12. The development of a national online database on ATs will help provide teachers, students and their families with accurate information on ATs and their availability in-country.

13. Support by government of the AT industry in-country is essential for a sustainable and viable AT industry.

14. Support of research and development into AT is essential to enable further development and localization of AT. Ensuring that AT software such as screen readers are available in local languages is of critical importance. Research and development can be supported by a mix of stakeholders including universities with suitable technical competencies and resources, industry and technical centers within disabled persons organizations (DPOs).

15. A range of current and near-future technology developments should be monitored by government and schools such as cloud computing, m-learning and the development of accessible Open Educational Resources.

16. Targets and timeframes for the development of publicly funded and private websites to be accessible according to the Web Content Accessibility Guidelines from the W3C should be implemented.

17. Consideration should be given to leveraging connected schools with accessible ICTs as accessible Multipurpose Community Telecentres (MCTs) for use by the wider community.

18. In the context of accessible MCTs based in schools, which provide employment and ICT skills training to persons with disabilities, consideration should be given to the sustainability of the centre’s business model. While much of the infrastructure can be made available at no cost to the community, careful planning is required to ensure adequate funding for trainers and course materials.
6.1 Conclusion

Persons with disabilities remain one of the most excluded groups in society. Equitable access to education is a vital part of enabling people to reach their full potential, and this has been emphasized as a human right for persons with disabilities in the UN Convention on the Rights of persons with Disabilities. This module has shown that accessible ICTs hold the potential to facilitate access to education for all persons with disabilities and enable them to become productive, visible and integrated members of society.

7 International texts, initiatives and goals on using ICTs to enable education and job training for Persons with Disabilities

“Thus in my own country and in many other friendly countries we persons with disabilities have been left in an exceptionally negative place, segregated from society and considered invisible by the rest of the community. It was traditionally assumed that so-called “special” persons were unable to learn, so that it was thought unnecessary to spend time and give attention for that purpose; all that was needed was to provide assistance in the form of health care, food and shelter, in other words a form of assistance based on public charity.” Mr Lenín Moreno Garcés, Vice-President of the Republic of Ecuador. Keynote speech at 48th International Conference on Education

7.1 World Summit on the Information Society (WSIS)

The World Summit on the Information Society, organized by the International Telecommunication Union (ITU), established a common vision for an information society for all and provided a framework to translate that vision into action. Phase 1, held in Geneva in 2003, developed a clear statement of the political will, vision and framework through its Declaration of Principles. The implementation of concrete activities was established in the Plan of Action. Phase 2, held in Tunisia in 2005, put this
Plan of Action into motion and established an Agenda for the Information Society in the Tunis Commitment.\textsuperscript{163}

\textsuperscript{161}World Summit on the Information Society http://www.itu.int/wsis/index.html

\textsuperscript{162}UN/ITU WSIS, Tunis Commitment, available at http://www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=2266|0


\section*{7.1.1 WSIS Key Principles}

The WSIS Key Principles and Plan of Action contain many commitments on the development of an Information Society that enables the education, training and employment of persons with disabilities. It recognizes the special needs of persons with disabilities and, under the Key Principles, highlights the importance of universal design and the use of assistive technologies in enabling access to the Information Society. It emphasizes that an inclusive information and communication infrastructure is an essential foundation to the Information Society and that national "e-strategies" need to take into consideration the "special requirements of people with disabilities."

The Key Principles and Plan of Action contain numerous obligations on the special needs of persons with disabilities which include:

- Accessible ICTs are to be used in all stages of education, training and human resource development (Declaration of Principles: 30).
- The \textbf{production of ICT equipment and services} are to be developed in accordance with Universal Design Principles and usable with assistive technology (Plan of Action C2 (f)).
• There should be an inclusive framework for ensuring **universal access to information and knowledge for all** (Plan of Action C3).

• **Capacity building**, addressing the need to **ensure the benefits offered by ICTs for all**, including disadvantaged, marginalized and vulnerable groups (Plan of Action C4)

• The production of **content** (multi-media, websites etc) that is accessible by people with disabilities and is provided in their own language (Plan of Action C8 23)

• The recognition of the unique potential of teleworking and **telecenters** to enable the equitable employment of people with disabilities and to enable them to work independently within their communities (Plan of Action C7 19 (c))

• The need for software to be accessible and **affordable** by all, in particular marginalized groups such as people with disabilities

• The need for collaborative efforts on the development of affordable software and to foster collaborative development, inter-operative platforms and free and **open-source software** for **education** and digital inclusion programmes (Tunis Commitment 29)

The International Telecommunication Union’s 2010 mid-term report on “**Monitoring the WSIS targets**” states that

“In view of the challenges faced in meeting the WSIS, MDGs [Millennium Development Goals] and EFA [Education for ALL] targets, it seems unrealistic to assume that conventional delivery mechanisms will be capable of ensuring the affordable and sustainable provision of quality and equal education opportunities for all by 2015. Indeed, the biggest challenge for many education systems is to be able to offer training or learning opportunities to traditionally underserved or marginalized groups.”

Accessible ICTs are increasingly viewed as a key means to deliver on the international development strategies and treaties referenced in this module.

UNESCO’s focus is on the human dimension of the information society beyond connectivity and infrastructures. Education, knowledge, information and communication are placed at the core of human well-being as nations move toward becoming inclusive Knowledge Societies. In 2003, UNESCO made available a series of publications summarizing some of the most essential issues related to the development of the information society, including ICTs and persons with disabilities. These publications are intended to measure the upheavals brought about by the emergence of ICT. They also
deal with the potential for development, the difficulties encountered, possible solutions, and the various projects implemented by UNESCO and its partners.

UNESCO’s World Report: *Towards Knowledge Societies*\textsuperscript{165} published as a contribution to the WSIS process in 2005, stressed the existence of multi-faceted digital divides in societies:

“There is not one but rather many digital divides. They are not exclusive and tend to combine according to local realities. There are numerous factors that contribute to the digital divide … economic resources, geography, age, gender, language, education, employment and disability”.


7.2 International Telecommunication Union (ITU) initiatives

The International Telecommunication Union is the lead United Nations agency for information and communication issues, and it is the global focal point for governments and the private sector in developing networks and services. ITU works to improve the telecommunications infrastructure of the developing world and, therefore, has a specific strategy on accessibility. This strategy focuses on:

- Making technical design standards accessible,
- Supporting the rights of persons with disabilities, and
- Providing education and training on accessible ICTs.

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7.2.1 ITU-G3ict e-Accessibility Policy Toolkit for Persons with Disabilities

The ITU-G3ict "e-Accessibility Policy Toolkit for Persons with Disabilities" is an online toolkit designed to assist policy-makers to implement the ICT accessibility dispositions of the UN Convention on the Rights of Persons with Disabilities. The toolkit is a global collaborative effort with more than 60 contributors from around the world. It provides a range of introductory information on the ICT accessibility dispositions in the UN Convention, as well as policy advice structured by government policy area.

**e-Accessibility Toolkit in brief**

The Toolkit is composed of the following main categories of information:

- An overview of the Convention and its dispositions covering ICTs,
- Demographics and statistical analysis of the worldwide numbers of people who benefit from accessible ICTs,
- Background on ICT accessibility issues,
- A resource guide for policy-making by core ICT areas such as, assistive technology, websites, software and access to published works,
- Universal design strategies for ICT products and serviced,
- Public procurement policies,
- Use of assistive technologies for persons with disabilities,
- Regional and international cooperation,
- The role of local governments, and
- Guidance on developing public policy in support of the Convention’s ICT accessibility dispositions.

The Toolkit also contains two further resources designed to help countries to prioritize policy development:

- **Guides by policy area**: A set of actions for governments to undertake under each administrative function such as telecommunication/broadcasting, education, and labour/social affairs; and
• **A Self-Assessment Framework**: Guidance on how countries can begin to collect data and identify gaps in relevant policy areas, with a view to prioritizing actions to meet the relevant ICT obligations under the Convention.

In addition, the Telecommunication Development Sector (ITU-D) is implementing a variety of projects in developing countries, including establishing community ICT centers equipped with assistive technologies so that persons with disabilities can partake in ICT literacy training. There also are ICT-enabled job training and projects targeted at the development of text-to-speech in local languages. Accessibility issues are also explored in Study Group 1 of the ITU-D, in Question 20-1/1, "Access to telecommunication/ICT services by persons with disabilities and with special needs." Details on the work of ITU-D on accessibility can be found at [http://www.itu.int/ITU-D/sis/PwDs/index.html](http://www.itu.int/ITU-D/sis/PwDs/index.html).

The Telecommunication Standardization Sector of ITU (ITU-T) has been promoting accessibility since 2000, through the concept of “Total Communication” and the principle of “Design for all,” with its Recommendation ITU-T F.703. These two initiatives began to promote the concept of Universal Design, enshrined in the UN CRPD, eight years before its adoption by the UN. Since then, many other standards – which are called “Recommendations” in ITU parlance – have been written for accessibility and for mainstreaming accessibility within telecommunication/ICT systems.

In addition, ITU-T developed the Telecommunications Accessibility Checklist, which enables standards writers – who are manufacturers, network providers, operating agencies, regulators, along with ITU Member States – to include accessibility and universal design principles during the early stages of the standards development process, instead of having to do often expensive retrofits into existing systems and services. Details on the work of ITU-T in accessibility can be found at [http://www.itu.int/ITU-T/accessibility/index.html](http://www.itu.int/ITU-T/accessibility/index.html).

166 The United Nations Global Initiative for Inclusive ICTs (G3ict) is a flagship partnership initiative of the United Nations Global Alliance for ICT and Development.

167 [http://www.e-accessibilitytoolkit.org](http://www.e-accessibilitytoolkit.org)
7.3 UNESCO Initiatives

UNESCO leads the global Education for All movement, aiming to meet the learning needs of all children, youth and adults by 2015. UNESCO promotes the ultimate goal of inclusive education, which it views as a means to ensuring a quality education for all and to achieving wider social inclusion goals.

In its “Guidelines for inclusion: Ensuring Access to Education for All” UNESCO defines inclusive educations as

“...a process of addressing and responding to the diversity of needs of all learners through increasing participation in learning, cultures and communities, and reducing exclusion within and from education. It involves changes and modifications in content, approaches, structures and strategies, with a common vision which covers all children of the appropriate age range and a conviction that it is the responsibility of the regular system to educate all children”.

UNESCO also promotes effective use of ICTs that are “accessible, adaptive and affordable.” It views the empowerment of persons with disabilities through effective use of ICTs as

“...not a charity, but the fulfillment of fundamental human rights as stated in 1948 in the Universal Declaration of Human Rights, highlighting that “all human beings are born free and equal in rights and dignity.”

UNESCO promotes empowering persons with disabilities through ICTs as a means of effective participation in inclusive education, culture, science and the enjoyment of human rights and social inclusion (Figure 7.1). (See the UNESCO document Empowering Persons with Disabilities through ICTs for more on UNESCO’s view on the interrelationship between accessible ICTs, inclusive education and human rights.)
UNESCO Policy Guidelines on Inclusion in Education 2009

UNESCO’s Policy Guidelines on Inclusion in Education 2009 state that inclusive education “is a process of strengthening the capacity of the education system to reach out to all learners, and can be thus understood as a key strategy to achieve EFA”. The three main motivators for inclusive education are:

- **Educational**: Inclusive schools, in which all children are educated together, develop ways of teaching that respond to individual differences and so benefit all children.
- **Social**: Inclusive schools foster positive attitudes towards diversity and form the basis of a just and non-discriminatory society.
- **Economic**: It is more cost effective to establish schools that educate all children together than to set up complex systems of different types of schools specializing in different groups of children.

One of the main areas of policy concern in the guidelines relates to the education and continuous professional development of teachers, many of whom are unfamiliar with the potential use of ICTs and...
may be unaware of how accessible ICTs can be used to assist students with disabilities in the classroom.


170 Ibid (footnote 169)

171 UNESCO Policy guidelines on Inclusive Education

172 UNESCO Guidelines for Inclusive Education, page 8

7.3.1 Salamanca Declaration and inclusive schools

In 1994, UNESCO organized an international conference to consider the “fundamental policy shifts required to promote the approach of inclusive education, namely enabling schools to serve all children, particularly those with special educational needs.” The Conference adopted the “Salamanca Statement on Principles, Policy and Practice in Special Needs Education and a Framework for Action,” known by shorthand as the Salamanca Declaration, which was endorsed by 92 countries.173 According to the Declaration, inclusive education requires that:

“… Schools should accommodate all children regardless of their physical, intellectual, social, emotional, linguistic or other conditions. This should include disabled and gifted children, street and working children, children from remote or nomadic populations, children from linguistic, ethnic or cultural minorities and children from other disadvantaged or marginalized areas or groups.”174

While many countries have well-established schools providing for the educational needs of children with specific impairments, the Declaration strongly recommends that, where countries have few or no special schools, efforts should be concentrated “on the development of inclusive schools and the specialized services needed to enable them to serve the vast majority of children and youth – especially provision of teacher training in special needs education and the establishment of suitably
staffed and equipped resource centers to which schools could turn for support.” When thus established, inclusive schools are more cost effective than maintaining a two-tier system of education.


7.3.2 UNESCO’s 48th International Conference on Education

The UNESCO International Conference on Education (ICE) is an international forum for policy dialogue, held by UNESCO’s 153 member states to progress UNESCO’s overall strategy for fostering quality education. At the 48th ICE, held in Geneva in November 2008, inclusive education was emphasized in the conclusion and recommendations as a key strategy in achieving UNESCO’s Education for All initiative.175 The proceedings state that inclusive education is an “ongoing process aimed at offering quality education for all while respecting diversity and the different needs and abilities, characteristics and learning expectations of the students, eliminating all forms of discrimination.”176 The use of ICT is emphasized as a means of ensuring “greater access to learning opportunities.”177

Analysis of National Reports on the Development of Education

National reports on the development of education were submitted by 116 countries for the Conference.178 The reports show a mix of modest progress and interesting innovations being made by developing countries in the use of ICTs for inclusive education:

• The Brazilian Ministry of Education views the provision of accessible ICTs as a means to “fight against poverty, social exclusion and culturalization.” To this end, the Ministry reports the installation of 1,251 multi-functional resource rooms equipped with “televisions, computers with printers, scanners and webcams, DVDs and software for accessibility, furniture and educational and pedagogical material specific to Braille, sign language, augmentative and alternative communication, among other resources of assistive technology for offering
complimentary specialized educational services." These rooms were installed between 2005 and 2007, with the aim of having 30,000 multifunctional resource rooms by end of 2011.\textsuperscript{179}

\begin{itemize}
  \item The Tanzanian Ministry of Education reported having “managed to improve the conditions of the buildings of some schools that practice inclusive education, as well as purchasing materials like Braille machines and computers for the blind and others.”\textsuperscript{180}
  \item In Barbados, “the role that computer technology can play in promoting the education of children with special needs is important, not only in teaching new skills but in providing access to the curriculum through assistive devices. Particular computer applications and devices make it possible for students with disabilities to be educated in a regular classroom alongside their non-disabled peers.”\textsuperscript{181}
  \item In Uzbekistan, “children with special needs, who don’t have physical opportunities to visit school, will be provided with a computer and computer multimedia training programs […] ” These computers will provide access to basic educational packages and resources.
  \item In Thailand, “education coupons are provided to assist towards the technology and special services needed, with each student with a disability entitled to a coupon of minimum baht 2,000 (USD 55) per year.”\textsuperscript{182}
\end{itemize}

While some reports are encouraging, and all national reports make reference to some provision for students with disabilities, very few prioritize the provision or use of accessible ICTs. A keyword search performed on all 116 national reports for a variety of terms associated with accessible ICTs revealed that the provision or use of accessible ICTs, and in particular learning materials in alternate formats, were present in only a small number of reports.\textsuperscript{183}

In 2010, UNESCO organized the ninth meeting of the High-level Group on Education for All, which took place from 23-25 February 2010 in Addis Ababa, Ethiopia. The resulting Addis Ababa Declaration\textsuperscript{184} emphasizes:

\begin{quote}
  “The six EFA goals and Millennium Development Goals (MDGs) will only be achieved if governments accelerate their efforts to guarantee education for marginalized populations. Opportunities in 2010, notably the MDG review process, must be utilized to revitalize efforts and support for EFA. Unless the global community takes determined and targeted action to reach the marginalized, there will be at least 56 million primary school age children still not enrolled in school in 2015.”
\end{quote}
In 2010, UNESCO published the “EFA Global Monitoring Report 2010: Teaching the marginalized.” The report indicates that children with disabilities are among the most marginalized and least likely to go to school.

“There are an estimated 150 million children in the world with disabilities, about four-fifths of them in developing countries. Millions more live with disabled parents and relatives. Beyond their immediate health-related effects, physical and mental impairments carry a stigma that often leads to exclusion from society and from school… Children with impairments that affect the capacity to communicate, and more severe impairments overall, typically have the most limited opportunities for education, especially in the poorest countries”.

UNESCO is launching a new project on “Development of inclusive information policies for use of ICTs in Education for Persons with Disabilities” (ICT4ED4PWD). The initiative aims to collect good practices in using accessible, adaptive and affordable ICTs in education for persons with disabilities. It also will examine existing ICT policies focusing on issues related to inclusive education, including persons with disabilities. A comprehensive set of recommendations will be prepared to enhance inclusive information policies around the world.

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177 One of the themes debated was “The Role of ICTs in Curricular Innovation”. One of the concrete areas for action was on “Flexible teaching methods and innovative approaches to teaching aids, and equipment as well as the use of ICTs”


180 Ibid (page 43)

181 Ibid (page 7)
“Empowering Persons with Disabilities through ICTs” - UNESCO’s Pavilion at ITU Telecom World 2009

ITU Telecom World 2009 was a major event for the global telecom and ICT sector, bringing together the key players from industry from around the world. The event promoted the notion of “knowledge societies,” in which everybody can create, access, use and share information and knowledge. “Empowering persons with disabilities through ICTs” was the primary thematic focus of the UNESCO pavilion at the conference. Through a series of workshops seminars and exhibitions, UNESCO conveyed its message that

“The empowerment of persons with disabilities, particularly through effective use of ICTs, is not a charity, but the fulfillment of fundamental human rights as stated in 1948 in the Universal Declaration of Human Rights, highlighting that “all human beings are born free and equal in rights and dignity”.”
UNESCO organized an expert meeting on “Mainstreaming ICTs for Persons with Disabilities to Access Information and Knowledge” on 22-23 February 2010 in Paris. The aim of the meeting was to discuss with experts how to facilitate implementation of the United Nations Convention on the Rights of Persons with Disabilities and to identify practical ways that UNESCO could assist its Member States in this international commitment. The following recommendations for action were offered:

1. Concrete activities to make UNESCO accessible;
2. Mainstreaming ICTs in inclusive education;
3. Mobilization of resources and international cooperation; and
4. Creation of an information and knowledge access ecosystem.

The UNESCO Institute for Information Technologies in Education (IITE)

UNESCO’s Institute for Information Technologies in Education (IITE) aims to promote equal access to education and inclusion of the most vulnerable segments of society through use of ICTs. To this end, IITE provides support for the development of policy on national strategies aimed at:

- Increasing disadvantaged and excluded groups’ access to ICT infrastructure;
- Promoting basic ICT literacy and vocational training programs targeted specifically at the most vulnerable segments of society;
- Supporting regional, sub-regional and inter-country cooperation and good practice exchange on the extension of ICT usage to excluded groups.

Training course: "ICTs in Education for People with Special Needs"

IITE has developed a specialized training course titled "ICTs in Education for People with Special Needs." The course presents the accumulated international experience in using ICTs to educate a wide range of people with special needs. It is designed to develop competencies for those involved in special needs education on a range of issues including:

- The importance of providing inclusive education to achieve equal opportunities for all;
- Relevant aspects of education for students with disabilities in the Information Society;
- The role of ICTs in providing inclusive education for students with disabilities;
- Reflective selection and use of assistive technologies (ATs) according to the specific needs of students;
- Appropriate educational conditions for successful application of accessible ICTs;
• Evaluation methods related to the educational use of accessible ICTs; and
• Advice on the development and implementation of ICT policy in education for children with disabilities.


7.3.4 UNICEF’s -1989 United Nations Conventions on the Rights of the Child

The UN Children’s fund, UNICEF, works for children’s rights, survival, development and protection. It is guided by the 1989 Convention of the Rights of the Child. This international Convention contains specific references to the right of children with disabilities to be protected from all forms of discrimination (Article 2). Article 23 indicates that parties to the Convention should promote a life of “dignity,” “self-reliance” and “active participation in the community.” Assistance should be extended to ensure that children with disabilities receive “education, training, health care services, rehabilitation services, preparation for employment and recreation opportunities” (Article 23 (3)). State Parties are also encouraged to participate in international cooperation to ensure that “information concerning methods of rehabilitation, education and vocational service” are shared in order to build capacity and experiences in these areas. (Article 23 (4)).

http://www.unicef.org/

8 Videos of assistive technologies

The following videos show a selection of the types of ATs that can be used to help control, manipulate and use a person’s environment and/or computer.

Augmentative and Alternative Communication

The following video shows how Ellen, an AT user, uses switches and an Augmentative and Alternative Communication (AAC) device to communicate, to access a computer and to control her surroundings at home and at college.

Assistive Technology for blind or vision impairment
The following video shows a demonstration of the BrailleNote computer.

The following video is a basic overview of the JAWS screen reader.
Alternative formats for deaf and hearing impairment

The following video shows how the use of captions and audio descriptions are essential for both deaf and blind students in the use of educational materials.

9 Technical Resources

The following subsections provide lists of resources in the areas of AT, accessible formats, curriculum development, needs assessment, telecenters, open-sources software solutions and other technologies explored in this module.

9.1 Educational resources for teachers and policy makers on assistive technology, accessible formats and curriculum development

The Adaptive Braille Writing Tutor project http://www.cs.cmu.edu/~nidhi/brailletutor.html#factsheet


Duxbury Systems software for Braille with Windows, Macintosh, DOS, and UNIX programs http://www.duxburysystems.com/
EDeAN. Resources on Universal Design Education and Training http://www.education.edean.org/

Edmonds, C. (2003). Providing Access to Students with Disabilities in Online Distance Education: Legal, Technical, and Practical Considerations. http://www.informaworld.com/smpp/content~db=all~content=a783720878


Gateway. Guidance for Assistive Technology in Education and Workplace Advancing Young People with Disabilities” http://www.gateway2at.eu

G3ict http://www.g3ict.org


ITU/G3ict e-accessibility Policy Toolkit for Persons with Disabilities http://e-accessibilitytoolkit.org


Microsoft information and tutorials on the inbuilt accessibility features in Microsoft products such as Windows 7, Vista and XP and Office products http://www.microsoft.com/enable/download/default.aspx

Microsoft. Accessibility: A Guide for Educators. “This guide from Microsoft provides information about accessibility and accessible technology to help educators worldwide ensure that all students have equal access to learning with technology.” http://www.microsoft.com/enable/education/

Technology and Social Change (TASCHA), University of Washington. First Workshop on Technology and Disability in the Developing World http://change.washington.edu/access/workshop_1/


University CSUN. Assistive Technology programme. [http://www.csun.edu/codtraining/](http://www.csun.edu/codtraining/)

University of Buffalo Assistive Technology Training Online Project [http://atto.buffalo.edu](http://atto.buffalo.edu)

WHO. International Classification of Functioning, Disability and Health (ICF) [http://www.who.int/classifications/icf/en/](http://www.who.int/classifications/icf/en/)

9.2 Assistive technology needs assessment


9.3 Assistive technology, software, resources, guides and projects

ABLEDATA: *AbleData - Your source for assistive technology information* from
http://www.abledata.com/

Ace Centre: *What is a communication aid*. http://www.ace-centre.org.uk/
index.cfm?pageid=DB6B5FE3-3048-7290-FE18A6FAEAF27C9B

index.cfm?pageid=DB6B5FE3-3048-7290-FE18A6FAEAF27C9B

AssistiveWare videos on computer accessibility http://www.assistiveware.com/videos.php


Autism Research Institute http://www.autism.org/

Better Living through Technology - extensive listing of AT and software for a range of disabilities
http://www.bltt.org/

Canonical Homepage http://www.canonical.com/


Dolphin Pen drive http://www.yourdolphin.com/productdetail.asp?id=8
GW Micro - Window-Eyes: http://www.gwmicro.com/Window-Eyes/

Free and Low Cost Solutions: http://abilitynet.wetpaint.com/page/Free+and+Low+Cost+Solutions


Freedom Scientific: Surfing the Internet with JAWS and MAGic http://www.freedomscientific.com/Training/Surfs-Up/_Surfs_Up_Start_Here.htm "Learn to use JAWS? screen reading software for Windows and MAGic? screen magnification software for Windows to read and navigate the Internet"


IBM Accessibility Centre Firefox: An open source accessibility success story http://www-03.ibm.com/able/resources/firefox.html

Inclusive Technology – AT supplier http://www.inclusive.co.uk/


Kurzweil Educational Systems http://www.kurtzweiledu.com

Laureate software for students with speech and language impairments: autism, and other neurological conditions http://www.LaureateLearning.com

Microsoft Grant Announcement http://www.nvda-project.org/blog/
MicrosoftGrant2008-2009Announcement

OneSwitch http://www.oneswitch.org.uk/index.htm

Overview of Technology for Visually Impaired and Blind Students http://www.tsbvi.edu/technology/overview.htm

Raising the Floor http://raisingthefloor.net/

Schoolnet resources on inclusive education and ICTs http://www.schoolnet.ca/?404=Y

Smart Kids Software - a portal of software companies that specialise in software for children http://www.smartkidssoftware.com


W3C-WAI *Introduction to Web Accessibility* http://www.w3.org/WAI/intro/accessibility.php

W3C-WAI *Evaluating Web Sites for Accessibility: Overview* http://www.w3.org/WAI/eval/Overview.html

W3C-WAI *Presenting the Case for Web Accessibility* http://www.w3.org/WAI/EO/2004/02/presenting_case.html


W3C-WAI *Web Content Accessibility and Mobile Web: Making a Web Site Accessible Both for People with Disabilities and for Mobile Devices* http://www.w3.org/WAI/mobile/

W3C-WAI *Techniques in WCAG 2.0* http://www.w3.org/TR/WCAG20-TECHS/
9.4 Free and Open Source Software (FOSS) solutions and articles

AEGIS IP initiative (Open Accessibility Everywhere: Groundwork, Infrastructure, Standards - http://www.aegis-project.eu/


Center For Adaptive Technology - Kenya Society For The Blind http://www.ksblind.org/site/?q=node/8

Comet Media Foundation http://www.cometmedia.org/ngo-in-a-box

Drupal Content Management System http://drupal.org/

DAISY Digital Talking Books http://www.daisy.org/dtbooks

eSpeak: Speech Synthesizer http://espeak.sourceforge.net/


Free Software Foundation: The GNU General Public License http://www.gnu.org/licenses/gpl.html

GNU Compiler Collection http://www.ohloh.net/p/gcc

Gnome Onscreen Keyboard http://www.gok.ca/

Inference Group: Dasher Project: Home http://www.inference.phy.cam.ac.uk/dasher/
Mozilla Firefox http://www.mozilla.com/firefox/


OATSoft - Open Source Assistive Technology Software http://www.oatsoft.org/

OpenOffice.org - *The Free and Open Productivity Suite* http://www.openoffice.org/

Open Source Business Models Strategies - Articles Research http://www.opensourcestrategies.org/

Orca - Open source screen reading software for Linux http://live.gnome.org/Orca

Ocropus - The OCRopus(tm) open source document analysis and OCR system http://code.google.com/p/ocropus/


pVoice - Augmentative communication software http://pvoice.org/


RoboBraille. RoboBraille is a free e-mail service which can convert digital text documents into either Braille or audio files. It currently Danish, English, French, German, Greek, Icelandic, Italian, Lithuanian, Norwegian, Polish, Portuguese and Slovenian http://www.robobraille.org/frontpage


Ubuntu homepage http://www.ubuntu.com/

University of Pune, Department of CNC , http://www.unipune.ernet.in/network/index.html

Virtual Magnifying Glass - A free, open source, screen magnifier, for Windows, Linux, FreeBSD and Mac OS X. http://magnifier.sourceforge.net/

University of Athens Accessibility Unit. An Open Source / Freeware Assistive Technology Software Inventory. http://www.ioustinos.com/fs/

9.5 Multipurpose Community Telecenters, accessible Telecenters and VTET for persons with disabilities

Telecentre for Disabilities - a discussion group with the telecentre.org association which supports and promotes accessible Telecentres for persons with disabilities [http://www.telecentre.org/group/telecentrefordisabilities?commentId=2086278%3AComment%3A17464]

Supporting Vocational Education and Training of Disabled People- a European funded project [http://www.epractice.eu/en/cases/eaccess]

ATRC Web-4-all "Web-4-All is the first technology in the world that makes it possible for users to carry with them their user interface preferences (including system preferences, browser preferences and assistive technology preferences) and quickly configure public terminals or learning management applications accordingly." [http://web4all.atrc.utoronto.ca/html/atrc/about_e.html]

10 Case studies

The following case studies illustrate the variety of ways in which persons with disabilities can be supported in using accessible ICTs to receive an education and job training skills. The case studies underline the different approaches to providing accessible ICTs for education and job skills training including:

- A bottom-up approach (Mexico),
- Working with local specialists to build capacity in AT (Brazil),
- The potential of teleworking (Tunisia),
- Building partnerships locally (POETA),
- The potential role of free and open-source software (India) and
- The role of international aid organizations (Kenya).?
Credits

The Module on "Assistive Technologies for persons with disabilities" was prepared by Dónal Rice (MSc). Dónal is currently working on a PhD at the Center for Disability Law and Policy at the National University of Ireland, Galway where this thesis is looking at the right mix of legislative and policy approaches in support of web accessibility. As editor of the ITU/G3ict e-Accessibility Policy Toolkit Dónal continues to collaborate with the ITU on updating and expanding this resource for policy makers on the digital accessibility dispositions of the UN Convention on the Rights of Persons with Disabilities. Dónal is the ICT design advisor at the Centre for Excellence in Universal Design at the Irish National Disability Authority.

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Module 5 Community ICT Centres for the Social and Economic Empowerment of Women

Introduction

The first two sections of this module set the context and need for community ICT centers to better target women users. They make the case for proactive policies and provide a step-by-step guide to ensuring that community ICT centers are designed with women in mind. Sections 3 and 4 provide thematic notes and case examples of women’s learning and information needs, from basic literacy to more sophisticated applications -- and how ICTs tools are being appropriated by this user group. The final two sections offer some guidelines to policy-makers and regulators from the local level to international policy frameworks.

Meanwhile, several sub-sections with sections 2, 4 and 5 suggest further reference and resource materials that can be downloaded from this toolkit for further information.

The annexes are divided into two parts, one outlines gender-sensitive data on ICT use and the second half is comprised of a select list of nine examples of software uses and community ICT centers across the globe.

1 Introduction to concepts and contexts

This toolkit begins with Section 1, which defines the community ICT center, introduces the concepts of gender and women’s empowerment and provides a background report on global access to ICTs and the gender digital divide.
1.1 What is a community ICT center?

*Information and communication technologies* (ICTs) include a whole range of technologies used for communication and for processing information. Today’s community ICT centers have developed as physical spaces that provide shared public access to ICTs, primarily through computers, satellite radios, telephones (fixed and mobile) and fax machines.

Over the last two decades, these centers have gained prominence as physical hubs for bringing the benefits of ICTs to communities where the technological infrastructure is inadequate and/or the costs of individual technology access are relatively high. They provide opportunities for access to information by overcoming the barriers of distance and location. Through facilitating this access, the centers have the potential to foster social cohesion and interaction.

These centers may be purpose-built around the provision of digitized and wireless services, or alternately, digitization and connectivity might be integrated into an existing information or learning center. Ideally, community ICT centers do not function as isolated information stations. Rather, as the name suggests, they form part of existing facilities and institutions, such as health centers, schools, libraries and other hubs, that provide a mix of services for the community. There are many different models of these kinds of physical hubs, and this module attempts to illustrate a range – particularly those that deliberately engage with women users.

1.1.1 The underlying purpose of a community ICT center

Although community ICT centers differ from place to place, their common purpose is to support community development while bridging the digital divide through the use of communications and computing technologies. They can play an important "community strengthening" role, while providing a 'last-mile' connectivity service to users. New ICTs are particularly helpful in addressing aggregated demands at the community level. They are versatile enough to meet not only the diverse needs of various social groups but also the range of demands of every individual in a community. Successful pilots have demonstrated that a diversity of models can be adopted to viably address the information and communication needs of an entire community. As technologies evolve, the community ICT centers will need to change accordingly to remain relevant and sustainable.
Communication technologies and associated community ICT centers can become more than access points for information, training and business. The physical space itself can be an entry point into a much broader communications and learning space. As technologies continue to evolve, so must our vision for community ICT centers. The outcomes are about more than just telecommunications – they are about building community and providing equal access for all.

1.1.2 What’s in a name?

Community ICT centers are referred to in a range of ways: telecenters or telecottages, public Internet access centers, village knowledge centers, infocenters, community technology centers, community multimedia centers, multipurpose community telecenters, common/citizen service centers and school-based telecenters.

Public perception of what a community ICT center should include may depend on how it is named. Centers that are essentially public access points may not be regarded as appropriate places for women and girls in some countries or cultures, and so how they are described is quite important. For instance, using a term like café might discourage women in Cameroon from using the local cyber-café because women do not generally frequent cafes. Calling it a boutique is more likely to attract women, so cyber-boutique is a term used in Douala by centers looking to attract clientele from both sexes. Similarly, using the term information center might have a more welcoming and inclusive public optic.

Fact of interest: Telecenter terminology in India

In India, the concept of a telecenter as a public access model for rendering various services has become a movement. Telecenters are providing a range of services and addressing many needs through education, farmer information or government-to-citizen services. They are referred to as telecottages, telecenters, information kiosks, e-Sewa kendras (electronic service centers), e-Chaupals (electronic gathering places), e-Haats (e-markets), village knowledge centers (VKCs), village resource centers (VRCs), Mahiti Manthana, community information centers (CICs), common service centers (CSCs), community multi-media centers (CMCs), etc. The wide-ranging terminology may seem confusing, but it reflects the plurality and diversity of the telecenter movement.
As telecommunication infrastructure has grown globally, so have community ICT centers. One organisation that works to support and improve telecenters globally is Telecenter.org. It has created and supported hundreds of networks and organizations that represent some 80,000 telecenters and close to 40 million telecenter users across the globe.¹

User analysis research consistently shows that, in most countries, Internet use is highest for those less than 24 years old and usage decreases with age. However, this trend is expected to become less salient over time and eventually disappear as younger generations grow up with the Internet and maintain usage into adulthood.²

¹ Telecentre.org was founded in 2005 by Canada’s International Development Research Centre, Microsoft and the Swiss Agency for Development and Cooperation (http://www.telecentre.org/notes)


1.2 Gender-related concepts and definitions

The term gender refers to the roles, responsibilities, relationships and identities defined for, or ascribed to, men and women within a given culture, society or context. Gender equality refers to equality of rights, voice, responsibilities and opportunities for men and women in society. Gender equity refers to fairness between men and women in access to society’s resources, rewards and opportunities. Gender gaps refer to societal differences between men and women that are considered undesirable.

A comprehensive source of basic terms and definitions relating to gender and ICTs is offered in the Gender Evaluation Methodology for Internet and ICTs.² This is an important resource for all readers:

http://www.apcwomen.org/gemkit/en/understanding_gem/genderanalysis.htm#jump11

Examining gender roles may lead to a greater understanding of the differences between women and men in terms of ICT use and its impact. A few examples of the questions raised along gender lines are provided here:
• In a given community, who makes household decisions? Where do they get their information from? (See text box below)

• In a given community, do women and men, girls and boys participate equally in the use of Internet facilities at a library or telecenter?

• At public ICT centers, are men visiting pornographic and violent sites and making women uncomfortable within that environment?

• In a development organization, is there a gender difference among those who use/appropriate email and those who do not? Is a general public email account assigned to a lower category staff members, who are usually women, compared with private email accounts of top management, who are usually men??

Fact of Interest: The information gap may contribute to male-dominated household decision-making.

In surveys in Ghana and Kenya, researchers found that women were less likely than men to say that they had sole decision-making power over household issues including:

• Saving or borrowing money
• Getting vaccinations
• Household spending
• Money transfers to/from relatives or others
• Going to a hospital or visiting a doctor
• Using birth control (in Ghana only… in Kenya, women were slightly more likely to report having the final say)
• Personal or family healthcare

Where women were accessing information, this was mainly from newspapers, radio and word of mouth. The survey did not capture data on ICT usage.

Source: www.audiencescapes.org

The Gender Evaluation Methodology in Section 5 provides more details on measuring and addressing these kinds of differences.
1.3 Why is it important to reach women and girls?

The simple answer to this question is that women and girls need to be deliberately selected as an audience because they still make up the larger proportion of those left behind – whether in literacy education, access to information, health or financial services, or general socio-economic empowerment. Women and girls still make up the bulk of the illiterate population across the world, and are more likely to suffer deep marginalization in conservative societies that limit their mobility and voice.

In addition to the digital divide between developed and developing regions, an ongoing gender divide persists, where women and girls have less access to ICTs than do men and boys. There are many reasons for this, ranging from outright gender discrimination to limitations in physical location or the reality that often women have less free time or disposable income. Women and girls from marginalized communities tend to be especially less engaged. Biases still exist within many social and cultural norms globally. Technology is sometimes considered to be interesting only to boys and men. Or, women are inaccurately thought to be uninterested or unable to learn how to use computer technologies. More often, low levels of literacy and overall education is a key barrier, while lack of freedom and control can also constrain access. Annex I presents a range of data that show differences in accessing the Internet between men and women on a country-level and on a global level.

If women remain excluded from ICT knowledge and services, they will become increasingly marginalized, the gender gap will grow, and many of the secondary benefits to be gained from women’s empowerment and gender equality will fail to materialize. Community ICT centers can counter this prevailing negative trend. If planned and executed properly, community ICT centers can be an effective vehicle to help women acquire literacy skills, numeracy skills, and resources to help them to start and build their own businesses, secure their livelihoods and become socially and politically active.

Promoting gender equality through increasing access to ICTs can strengthen women’s and girls’ access to, and generation of, information, despite the mobility and cultural restrictions they face. They can broaden their skills and, subsequently, their economic activities. Such skills allow women to explore and pursue new business opportunities, to establish enterprises of their own, to enter new markets that require capital investments and to access a range of resources, including micro-financing.
Sections 3.2, 3.4 and Chapter 4 draw these links further.

Fact of interest: ICTs and adolescent girls’ assets

PLAN Canada\(^3\) cites seven reasons why access to technology can counter gender inequality and build girls’ assets:

1. To keep in touch with others, reducing girls’ isolation in countries where this is an issue;
2. To increase education and ability to acquire new skills;
3. To allow girls to take an active role in their communities and countries;
4. To increase their skills to find employment;
5. To build specific skills and knowledge on subjects they might otherwise not know about, such as HIV/AIDS;
6. To build self-esteem (by learning how to use technology); and
7. To increase safety.

1.4 A note on women’s empowerment

Women’s empowerment is focused on increasing their ability to take control over the decisions that affect their lives. This includes access to, and control over, information, resources, decision-making and the distribution of benefits. For women who can access and use ICTs, this can mean access to information on education, health, public and private rights, as well as income-generation and market information. The United Nations Department for the Advancement of Women (UNDAW), meeting in November 2002,\(^4\) expressed this as, “…when there is an enabling environment, ICT[s] can provide diverse avenues for women’s social, political and economic empowerment.”

Despite some greater appreciation of the multi-causal nature of social change, an assumption that underlies much policy thinking is that economic growth is the principal motor of change in gender relations. This is only partly true. While the social transformations that have affected women’s lives can

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\(^3\)Plan International (2010) Because I am a Girl

\(^4\)UNDAW (2002)
be associated with economic development, they are not simply a by-product of economic growth. Some countries with similar per-capita incomes—such as Sweden and the Gulf States of Qatar, Saudi Arabia and Kuwait—show marked disparities in women’s rights and status. Female employment rates are also subject to considerable variations that do not always correlate with gross domestic product, with the lowest rates being recorded in the Middle East and North Africa.

Among the many factors that initiate or accelerate change in women’s social and economic status is purposive action -- working through state reforms and social movements. This is evident if we consider the last decades of the twentieth century, which were particularly significant for the gains that were made in international policy relating to women. The momentum of second-wave feminism, and the efforts of international humanitarian and development institutions, combined to bring about significant changes in women’s rights. By the early 1990s, most states had signed up to the Platform for Action and the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), and their commitments made to support women’s equality.  

Information and communication technologies and their impact on and use as an instrument for the advancement and empowerment of women. Expert Group Meeting Republic of Korea, 11 - 14 November 2002

Beijing Plus 10: An ambivalent record on gender justice by Maxine Molyneux and Shahra Razavi

1.5 A note on technological changes

From the emergence of the personal computer almost 30 years ago to the explosion of the Internet in the last decade, each new wave of information technology has changed how individuals, communities and organizations can communicate, connect and coordinate with each other.

The next trends in technological change will continue to make computing more affordable, more portable, more powerful and easier to use. Barriers like cost, physical access, and knowledge of specialized technical skills will continue to be lowered, making these technologies more accessible to more people. Arguably, these factors will favour increased access for women users.
At a conference on ICT best practices in Africa in April 2008, the CEO of Microsoft summarized these technological trends as:

- More processing power in smaller devices;
- Storage expanding dramatically in PCs, devices and in datacenters around the world;
- Wireless broadband networks becoming more common, enabling people to tap into processing power and storage from almost anywhere;
- Natural user interfaces that take advantage of voice, handwriting, and gestures becoming more commonplace and user-friendly; and
- Screens and projection devices becoming lighter, better and more affordable.

All these technological developments could have positive implications for the community ICT center. In the meantime, the increased uses of wireless and mobile technologies are having the large impacts globally. Mobile technology is increasing access, due to the relatively low entry costs associated with owning and using a cell phone and also due to higher levels of investments in cell phone infrastructure in emerging economies. Mobile use will continue to escalate as its capacity converges with the computer.

Cities and regions everywhere are turning to wireless technologies. Kigali, Rwanda, for instance, is set to become the first “hotspot” capital in Africa this year.\(^6\) Wireless technologies now allow for community ICT centers to be portable and to reach more users, as is the case with e-Trikes in the Philippines.\(^7\) Wireless technology also has the potential to reduce costs, in some cases, through the sharing of Internet connections. The multiple uses of wireless applications cannot be overstated, and the case studies in the following chapters will further illustrate this point.

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**Fact of interest: wireless for livelihoods and micro-businesses – UNCTAD report**

The [UNCTAD Information Economy Report 2007-2008](https://unctad.org/en/PublicationsLibrary/inf2008en.pdf) found that both mobile telephones and telecenters support livelihoods in developing countries. The study illustrates ICT contributions to poverty reduction by focusing on two examples: (1) the use of mobile telephones for conducting micro-business in Africa; and (2) the creation of telecenters for the benefit of poor communities.
In Africa, there were 50 million new mobile subscribers in 2006, and in 2007 the total number of mobile subscriptions reached an estimated 200 million. These mobile phones have become an essential entry point into the information society. Mobile telephony is a critical tool for sharing information and intelligence, and it empowers households and communities to stay connected.

To understand how telecenters support livelihoods among the poor, UNCTAD surveyed a number of telecenter networks in Bangladesh and India. The survey assessed which services telecenters are providing, who benefits from those services, and what are the key environmental and institutional factors that enable telecenters to help the poor raise living standards. The results show that most telecenters are concentrating on providing access to ICTs and on developing basic ICT skills. In line with the type of services offered, telecenters are primarily used for information and education purposes. The report addresses gender differences in access to telecenters, with case studies notably from countries like Chile. The report also addresses the difficulty of recording and accessing gender-based user data.

Fact of interest: cell phone surveys for monitoring and data collection

Basic cell phones outfitted with a customized application, the EpiSurveyor, were used in a two-week pilot study in Mpika, Zambia in June 2010, which involved local volunteers – all women. The phones were used to collect routine information on the wellbeing of school girls. The women recorded the answers with simple button clicks on the phones, which were immediately transmitted to Lusaka, the capital. Learning to use the software quickly, the women completed each questionnaire in just 2-3 minutes. Then they uploaded the data by cell signal to a central database for analysis.


The eTrike is a fully self contained mobile, wireless telecenter which travels into urban communities in Manila and provides you with access to participate in new digital ICT technologies, basic computer lessons and an introduction to the Internet. Mobile telecenters Philippines – e-Trike. 
(http://www.mobiletelcenters.com/)

2 How can community ICT centers reach women?

This chapter looks at elements of best practice, focusing on four primary areas:

1. The overall policy environment,
2. Guiding principles for inclusiveness,
3. Women-specific design elements of a community ICT center, and
4. Governance and financial viability concerns of the center.

2.1 The overall policy environment

The development of ICTs, and the benefits that may accrue to women from using them, are conditional upon the ability of countries and regions to support effective, pro-active and deliberate policies that push for the social inclusion of women in all spheres of economic and social activity and decision-making.

In the absence of deliberate policies, the diffusion and use of ICTs and their intended benefits can actually exacerbate existing income and economic divides, with the poorer sections of the population being further marginalized, exploited and impoverished, as a result.

The success of a community ICT center requires more than telecommunication infrastructure, it requires targeted support programmes by governments, the private sector and NGOs to train users, operators and service providers. To fully realize their potential, community ICT centers need a policy environment that supports systems and appropriate policies for sustainability. For example, policies
should ensure gender equity in the implementation process, promote pricing policies that favour community center services, and develop investment incentives for universal access. If policy-makers want to prioritize universal access, they need to focus on the demands of their rural and peri-urban populations.

The well-developed community center is also an invaluable tool for the role that governments play in today’s economies. As citizens become more familiar with frequenting these centers and using Web-based services and information, they will positively value any public services provided by government via ICTs.

Although international and national policies may exist for gender equality and universal access to ICTs, few of them specifically consider ICT and gender together in an integrated way. The absence of gender-oriented projects and programs in ICT increases the risk of a growing “gender digital divide.” Policy-makers, along with gender and ICT advocates, must be aware of the profound impact (positive or negative) of how gender is managed. A gender perspective on ICT matters is essential if the gender digital divide is to be bridged. Since ICT is becoming increasingly central to all economic, political and social life, it is also central to advancing gender equality.

A political commitment to policy and regulation has a critical role to play in determining whether or when ICTs become available to all parts of civil societies, especially poor, rural, dispersed or marginalized communities. A progressive framework of access to ICTs that addresses women’s empowerment should regard access to ICTs as a “capability right.” These sections of population can, through the appropriation of ICTs, gain legitimacy for their concerns, demand accountability from public institutions, and explore new platforms for building solidarity and for learning and knowledge sharing. Guidelines in Chapter 5 provide policy- and decision-makers with a further set of criteria to use in policy making.

A public goods approach is vital for women and women's groups to access ICTs, to leverage the propensities of the evolving information and communication ecology for furthering their struggles, whether they revolve around the right to information, the right to livelihoods, the need for educational content in local languages, current community radio initiatives or accessing local services. Public financing instruments and institutional arrangements that tackle these needs head on are critical to realizing the capability rights of women through ICT access.
Economic and social development depends on the capacity to generate, absorb and diffuse knowledge and technology. Knowledge and technology have the potential to provide benefits to large numbers of users, and the benefit received by any one user does not reduce the benefits received by others. Knowledge is often considered a public good, but it is more complex than it first appears. Several important qualifications must be considered. These qualifications are crucial to the design of appropriate policies to increase the rate of innovation and to guide its direction, at both the national and the international levels.10

Fact of interest: defining sustainability and public good

The fundamental issue in reaching poor women is not one of profitability, but rather the creation of a set of technology-mediated services and products that will enable women to engage in emerging opportunities. Focusing on financial viability, to the detriment of a committed focus on the transformatory and development capabilities of ICTs, could work against the objective of universal access.

Governments and NGOs alike need to view the economics of communication centers within frameworks of justice and equity. Public information delivery has to be guided by the cornerstone of accountability rather than of profit. Initial investments required to set up a telecenter will start paying off when information begins to have positive influences on the community – in terms of social and economic well-being, as well as transformation in social relations at community and household levels – as women and the poor start leveraging information and communication resources.

Researchers distinguish between economic sustainability (achieved when a given level of expenditure can be maintained over time), social sustainability (achieved when social exclusion is minimized and social equity maximized) and institutional sustainability (achieved when prevailing structures and processes have the capacity to perform their functions over the long term). Economic sustainability is a key indicator of the success of a project because it is seen to reflect a genuine demand for that service. At the same time, in many development projects, donors are funding information dissemination as a public good. “The nature of telecenter sustainability is complicated by the point that it may initially be a public good, especially in disadvantaged areas, yet must be ultimately self-supporting.”11
A great deal of research has been published on economic sustainability, in particular with regard to access initiatives such as telecenters or information kiosks, which have high set-up and maintenance costs and customers with little spare cash. The complicated objectives of providing information services as a public good, and making them self-supporting, have proved extremely difficult to reconcile. Few initiatives have succeeded in covering their costs, even if they have developed viable charging mechanisms.

Functional coordination between various government ministries and local officials is central to developing a supportive policy environment. The establishment of an ICT policy task force may also help to bring together stakeholders from all of the relevant ministries, such as education, telecommunications, gender and youth affairs, industry and commerce, etc.

9 (…) most universal access programmes that focus on providing Internet access in rural areas concentrate exclusively on the roll-out of infrastructure. Studies show, however, that the most successful community Internet center programmes are those that are linked from their inception to a wide variety of capacity-building and support programmes that are implemented jointly between government entities, local communities, businesses and NGOs. Successful universal access programmes depend not only on the availability and affordability of infrastructure, but also on the availability and quality of suitable content and applications, as well as the level of training of its users, operators, and service providers”, ITU Trends in Telecommunication Reform 2007 The road to next-generation networks (NGN), Geneva, International Telecommunication Union, 2007.


2.2 Guiding principles for gender inclusive design

Two fundamental principles should guide the development of any community ICT center, in order to integrate the needs of women and girls: participatory community involvement and partnership development.

Principle I: Participatory community involvement

From the outset, actively engaging women and girls throughout the process of designing and establishing a community ICT center will ensure that its services, location and management reflect and respond to the needs of this constituency of users. Participatory involvement must provide a realistic and deliberate opportunity for women and girls to have their ideas considered equally for the design, implementation and operation of the center – and so promote a sense of "ownership" or "belonging." Participatory methods may include individual or group interviews, focus groups, needs surveys, community outreach events, or broadcast communications (radio, posters, etc.). Ongoing dialogue with the community is essential to tailor the community ICT center to the needs of the community it serves.

Key community stakeholders should also be engaged to maximize community involvement. This would include teachers, school principals, faith leaders, business leaders, local government representatives and other local champions. The higher the level of engagement, the stronger the community ownership of the center will be. Additional stakeholders may include NGOs, farmers’ groups and industry.

Fact of Interest: a simple rural appraisal tool from India

In India, Change Initiatives put a Web-based information system to strategic use for the benefit of poor women of Baduria, a rural region in North-24 Parganas district in the Indian state of West Bengal. In 2002, concerned over the lack of penetration of ICTs among the rural poor, Change Initiatives found that absence of information and an information-sharing mechanism among poor women had thwarted their ability to fulfill basic needs, restricted their awareness and blocked their desire to break barriers that limit their participation in society.
The findings were the result of a survey among women's NGOs and self help groups (SHGs) in rural regions of North-24 Parganas. For this project, dubbed “Nabanna,” Change Initiatives developed a novel participatory rural appraisal tool that allowed it to ask the candidates to maintain diaries on their lives. The diaries were an effective tool for needs assessment, in addition to being a vehicle for self-expression.

Staff, trainers and administers should come from the community. Being led by those who understand the community and the context (e.g. the community’s history, present needs, main activities, cultural context, etc.) will only improve impact and inclusion. In Cambodia, for instance, at the start of the iREACH project it was very difficult to attract women, let alone to encourage them to run in interim management committee elections. However, after having been involved with iREACH for some time, women became more comfortable with entering the committee elections, with a resulting strong competition for the female quota of seats.¹²

Principle II: Partnership development and building community linkages

The "public face" of the community ICT center should be friendly to girls and women. The community ICT center should develop and maintain working relations with those agencies that work with and for women, and should provide a service to these agencies. The center’s administrators should be acquainted with how other institutions (e.g., schools, hospitals, health clinics) and organizations serving the community operate, so as to see how the ICT center can work in concert with these.

Building strong community linkages will increase the inclusiveness and outreach of the center. For example, if training is provided on basic computer skills and how to find a job, the center could then link with local employment organizations (both governmental and non-governmental) or the Chamber of Commerce.

¹²Gender, Empowerment through ICTs, iREACH, Cambodia
2.3 Women-specific design elements of the community center

A basic design framework that addresses women’s socio-cultural contexts and information needs might include the following:

2.3.1 Data and record keeping should be gender-disaggregated

Community ICT centers should maintain a high-standard, itemized record of usage of services by type, and by type of user, including age and gender. This data is critical for identifying gaps in usage, for improving service and outreach to unmet constituencies, and to budget forecasts and planning. The UNDP and UNIFEM have produced a useful online guide: A User’s Guide to Measuring Gender-Sensitive Basic Service Delivery, which can be applied to ICT services delivery.

Despite a broad recognition of a gender digital divide, there is still a significant lack of data or gender-disaggregated statistics on ICTs. This makes providing factual evidence difficult. In 2005, the United Nations Division for the Advancement of Women recommended compiling gender-disaggregated data on the use of ICTs and women’s participation in policy-making, as well as developing targets, indicators and benchmarks to track real progress in access and benefits. Monitoring and evaluation procedures and processes that take gender differentials into account will provide baseline data and comparators on women’s ICT use.

Fact of interest: Gender Evaluation Methodology (GEM) for telecenters

The Association for Progressive Communications (APC) is an international network and non-profit organization that promotes access to the Internet. It has created the Gender Evaluation Methodology (GEM), a free online tool designed to assess whether and how ICTs are contributing to gender equality. It is a useful way to integrate gender analysis into evaluations of initiatives that use ICTs for social change. GEM helps determine whether ICTs are really improving women’s lives and gender relations, while also ensuring that gender concerns are integrated into project planning process. GEM
uses gender analysis to promote positive change at the individual, community and institutional level. Gender evaluation for Telecenters reflects the collective lessons of GEM as it was applied to the running of telecenters in Colombia, Mali, Peru, the Philippines and Uganda. The guide looks at what is possible in the face of stretched resources and presents workable solutions for some common telecenter challenges.

As a note of caution however, ICT access statistics on their own are not a true indicator of women’s empowerment. For example, women’s comparatively higher education, small business leadership and access to ICTs in the Philippines and in Thailand do not automatically translate into women’s equal representation in leadership or government positions. Similarly the mere fact that more women might be employed in the manufacturing sector of ICTs does not mean that these women are benefitting from literacy or learning programs or gaining leadership, communication or negotiation skills.


2.3.2 The ‘Community responsiveness’ of the center must identify and cater to girls and women’s activities, interests and information needs

The center’s services and programmes need to be directly responsive to societal development priorities and needs. These may include offering literacy and related learning programs, expanding digital capabilities (including communication and accessing information), improving equal rights for minorities and the disadvantaged, or providing distance working, lifelong learning and citizenship and administrative services in the community. In some contexts, ICT training programs may need to consider providing all-female sessions. This can be further enhanced by engaging women as teachers,
mentors and role models. Women sometimes lack confidence or voice in mixed-gender training sessions.

More often than not, women coming together for training will begin to articulate what their information needs and interests are, and some simple websites can be designed to provide timely and dynamic information of immediate relevance to the group. In this way, women can be organically involved in developing their own Beb-based content.

**Content example: SEWA’s integration of ICTs in informal sector activities**

India’s *Self-Employed Women’s Association* (SEWA) has been organizing women in the informal sector since 1972, and has a membership of over 215,000. One of the first organizations in India to realize the potential of harnessing ICTs for the productive growth of the informal sector, it organized computer awareness programs and offered basic computer skills to its team leaders and association members.

SEWA is implementing a well-considered strategic plan for integrating ICTs into its main activities. The organization uses software applications developed for its embroidery, watershed development, salt production, and savings and credit projects. The software can generate customized reports on artisan membership, and it can grade products, record market activities, and keep accurate, up-to-date information for efficient production planning.

SEWA has also used video as a tool for women’s empowerment. VIDEO SEWA has produced video footage on many issues affecting the livelihoods of poor women, using the medium to share information and raise awareness among members. Video is a tool for training and teaching new skills, as well as to reach policy makers, making the medium an integral part of SEWA’s activities. SEWA’s satellite technology program has enabled the organization to work in more than 10 districts of Gujarat, where it provides interactive training that links women to experts and policy makers.

**SEWA’s Trade Facilitation Center** has had some success in its e-Commerce endeavours, supported by its websites [www.banascraft.org](http://www.banascraft.org) and [www.kutchcraft.org](http://www.kutchcraft.org). One innovative approach to reach producers and artisans who are under-served by connectivity involves putting women producers in touch with a cadre of computer operators, who perform a variety of supportive functions that enable on-line selling. ICTs can thus improve many organizational functions in a member-based organization.
like SEWA, including identity- and solidarity-building, linkages with, and access to, government offices, internal governance and capacity-building.

2.3.3 Develop content and training materials with and for women

Women’s information needs are closely related to their economic and social circumstances (e.g. whether they live in a rural or urban area, their literacy level, whether they are self-employed or work as an employee, etc). Consequently, for content to be relevant, women and girls’ local needs must be assessed on the basis of their social, educational and economic context, as well as on the opportunities available to them for development and empowerment through ICTs. Access to available content will be predetermined by its relevance for women and girls’ specific needs and whether it is in a language used in the community. The Internet is growing as a provider of information on health issues, women’s rights, and on economic and employment opportunities, such as the availability of training and financial services. But if women do not have basic Internet and computer skills, the Internet will remain out of their reach.

- As part of a programme to expand access to ICT, one can:
  - Develop new online content with indigenous knowledge;
  - Translate information into local languages and dialects;
  - Use the Internet to disseminate information on local traditions and cultural expressions; and
  - Provide information on local events and services.

New content can be produced to challenge local stereotypes pertaining to women and girls. For low-income or vulnerable women, the production of new content cannot be solely market-driven. It is a source of more autonomy, empowerment and self-determination for empowering women, and ought not to be available only to those who can afford it. Ongoing training should also be provided to enable
women to develop Web content for themselves. Simple first steps can include using local languages and incorporating a strong visual component. Both have been found to improve engagement for women (and men) with limited literacy.

An example from the region of Uvira, Democratic Republic of Congo, shows how women farmers are using ICTs to learn about agriculture. A local organisation, IFDAP (Initiative des femmes pour le développement de l'autopromotion et la paix), formed a support group for women farmers. In early 2009, the group increased access to agricultural information by facilitating Internet access to rural women farmers. Through this, and IFDAP’s recently launched information center, so far, up to 150 men and women have received needed information on agriculture.\(^{15}\)

### Fact of Interest: men and women may have different information interests

The APCNews of 2010\(^{16}\) carries a series of case studies on ICT initiatives that have been evaluated using gender-evaluation methodology. The first case is the Bumawa telecenter, located in a small town on the Ugandan banks of Lake Victoria. The telecenter was seldom visited by women. A GEM\(^{17}\) study uncovered that men and women were interested in different information – women in health, vocational training and food security – whereas men searched for information on politics, economics and business.

Women users were much less likely to read English than the men, and were frequently frustrated in their search for relevant content. Often, they would return home to unfinished household chores - never to return. In comparison, if men couldn't find the information they were looking for, they still lingered at the telecenter, playing games and familiarizing themselves with the facilities. Following the evaluation, the telecenter began to offer equal-opportunity training targeting women over 30 years of age and catering content specifically to their interests.

**Content drives traffic.** A community center that delivers services and/or information pertinent to women’s needs and interests will automatically attract women. By extension, a community center that offers a range of IT-based services and information to women will attract regular visits by women. These services can be both private (“individual in nature”) or public (“collective in nature”), and the
content can range from generic learning software, to specific training materials with qualifications (see Amref e-learning for nurses) and context-specific content developed by local women for their own use.

**Fact of interest: Telecenters in the Philippines attract more women**

In the Philippines, public telecenters tend to attract far more women than men. A study looked at two rural telecenters, using the Association of Progressive Communication’s (APC’s) gender-evaluation methodology. It found that because the telecenters did not allow games or pornography, men were less interested in occupying seats in those centers.

These tools are profoundly pluralistic, democratic, and hyper-individualistic, yet globally collaborative and interdependent, and extremely powerful. As these community ICT centers link in with formal and informal school and vocational training networks and become part of the “learning fixture” available to all levels of learning, women should gain a higher potential for using the facilities and influencing the range of services and training offered.

**Fact of interest: ICT training and holistic programming in India**

The Seelampur Community ICT Center deploys innovative IT solutions for skill enhancement, and provides holistic programming for women and girls, including content related to education and skill building, health, legal rights, micro-enterprise and entrepreneurship, information sharing and networking and non-formal literacy. It uses interactive multimedia tools to support vocational and life-skills training to poor girls and women, including awareness-building on health issues and food preservation, as well as support to professional activities such as tailoring and quilt-making. Vocational training programs include fashion design, media development and basic computer literacy, beauty culture, and arts, crafts and painting. Further, the Gender Resource Center offers monthly health camps (with access to doctors, medicines and referrals), nutrition and AIDS awareness camps and legal awareness sessions twice a week.

An information center is also run where beneficiaries can ask about old-age pensions, loans and financial aid. The information help desk organizes weekly meetings about beneficial schemes, self-help groups, life skills and awareness programs, and it has Internet connectivity. The center also assists women with issues such as feticide, dowries, family violence and injustice. It partners with the...
Delhi government to ensure welfare schemes reach the most marginalized women of the community. See Datamation?Gender Resource Center Case Study for more information.

Women in the Democratic Republic of Congo: Confidence and a competitive edge though ICTs

http://www.apc.org/


2.3.4 Make the community center physically accessible to women and girls

Location is an important consideration when designing a community ICT center that integrates varying gender needs, and the social context must be measured carefully. Certain cultural beliefs may limit or prevent access to centers and issues such as personal safety and privacy must also be considered.

A community ICT center can be a standalone physical space or it can be integrated into other spaces that women and girls might frequent, such as schools, temples, mosques, pagodas or churches, health clinics, post offices, market centers and other government or ministry offices. The location of a community ICT center could prevent women from attending if it is near bars and nightclubs, or other places not considered suitable or safe for women. Other public places should also be actively considered -- always bearing in mind their accessibility to women within the cultural parameters of the society in which the center is being set up. It often takes a small group of women to break through initial barriers and, over time, to encourage others to join in.

Fact of Interest: Rural locations in post offices, Malaysia
The **Rural Internet Centers** (RICs) in Malaysia were set up by the Ministry of Energy, Communications and Multimedia (now Ministry of Information, Communications and Culture) in post office buildings. The post office is an ideal location, as it provides outreach to remote places, it is secure and it is a place frequently visited by the community as a one-stop center to pay utility bills and make many other transactions. Each RIC consists of between five and eight computers with Internet connectivity. The usage of computers for Internet browsing is free for the members; a minimal fee is charged for non-members.

**Operating hours** - Gaining an understanding of the time schedules, and the cultural and social context of the community, will help to establish a schedule that is gender-sensitive. In some cases, opening the center during women-only hours can also be an incentive to women’s participation. Operating hours need to consider when women and girls are more likely to access the center, and to make allowances for their time limitations. In many cultures, women have family and household obligations, leaving them with little spare time. The best course of action is to find out from a diverse sample of women when the ideal hours of use might be for different groups. Many of the examples that successfully engage women users allocate specific times for women-only sessions, or link the training directly to schools and colleges so that women have access during dedicated classroom time.

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### 2.3.5 Privacy and security concerns

Women may require extra privacy to feel comfortable using ICTs; in a conservative society, this might mean a women-only space. Women and girls should be able to have their own email accounts and be able to freely access information without surveillance, while having access to secure online spaces free of harassment and exploitation.

Women need to be made aware of the "etiquette" of using the Internet, as well as the potential risks from "scammers," software viruses and other related downsides of internet use. They will need basic protection from cyber-crime. As technology evolves, so does cyber-crime. Cyber-offences can take many different forms, such as stealing personal information, exploiting the sale of innocent victims (as in the sex trade), and attacks on personal safety. Women and girls must be educated to understand the risks involved and how to mitigate harm. For example, passwords for email access should not be
stored on a public computer, and users need to log out of their email accounts before leaving the public computer. This kind of training should be part of any digital literacy course.

The ITU has a set of on-line Child Online Protection Guidelines\(^\text{18}\) in six languages, identifying risks that children may face online and behaviours recommended for children to stay safe online. PLAN Canada\(^\text{19}\) also sets out child protection online safety rules for adolescent girls:

<table>
<thead>
<tr>
<th>Content example: PLAN Canada’s safety rules for adolescent girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>• No personal details like your address or school</td>
</tr>
<tr>
<td>• Don’t send pictures</td>
</tr>
<tr>
<td>• Don’t hand out your password</td>
</tr>
<tr>
<td>• Never arrange to meet anyone in person</td>
</tr>
<tr>
<td>• Never hang around in a chat room if someone says or writes something that makes you uncomfortable or worried</td>
</tr>
<tr>
<td>• Never respond to nasty, suggestive or rude emails</td>
</tr>
<tr>
<td>• Never believe junk or spam email</td>
</tr>
<tr>
<td>• Don’t open files from people you don’t know</td>
</tr>
<tr>
<td>• Always report when you see bad language or distasteful pictures</td>
</tr>
<tr>
<td>• Always be yourself</td>
</tr>
<tr>
<td>• What is posted online becomes public and cannot always be removed. Don’t post about friends, family and teachers</td>
</tr>
<tr>
<td>• If someone keeps trying to talk to you, press you for information or threaten you, tell someone you trust and get help.</td>
</tr>
</tbody>
</table>


\(^\text{19}\) From Plan Canada BIAG site
2.4 Governance and financial viability concerns

This section explores ways to ensure that gender sensitivity is built into the management and support structures of the community ICT access center.

2.4.1 Gender-sensitive governance structures

The entire governance structure of community centers should reflect gender-sensitivity – including in the composition of their boards of directors and the selection of senior executives and project managers. Job descriptions or terms of reference need to specify the importance of understanding and articulating development issues and ICT impacts from a gender perspective. Gender advisors to both board and staff should become part of general governance policy. While ownership and governance structures of community ICT centers may be diverse and wide-ranging (from micro-enterprise, to community-based, not-for profit to government run) certain core principles apply to all ownership models. These include:

- The Board of Directors or Advisory Committee should agree on a quota of women members. By setting an example at this level of management, other gender balances might extend to the technical team, the trainers and female attendance generally.
- "Community ownership" of the center should include representatives of women’s interests. The decision-making structures of these centers need to ensure that women stakeholders are involved right from the initial conceptualization and design, all the way through planning and implementation processes. This will involve establishing a consultation process that engages all community stakeholders on a regular basis. Women’s inputs and perspectives can help in deciding questions about location, safety issues, opening hours, content, programs and services. See Maarifa Centers Content Example in Section 4.1.
- Develop criteria for awarding licenses that meet gender specifics. This could include awarding licenses to those businesses that meet certain conditions; for example, the number of women technicians on staff, disaggregated data collection and record keeping, and the number of women in management positions.
2.4.2 Financing the ICT Community Center – capital and start-up costs

An APC study, *Unbounded Possibilities: Observations on sustaining rural information and communication technology (ICT) in Africa*, studied two different telecenters in Tanzania. One promoted the idea of enterprises "bubbling up," given the right environment, and the other was modeled more on the approach that economically poor communities require a "big push" -- i.e., big projects and big changes. The report suggests that both approaches are valuable, although the "bubbling up" approach could lead to more sustainable ICT development.

The first case study looks at the Family Alliance for Development and Cooperation (FADECO), a small association based in a small town, close to the Burundi and Uganda borders, that works to provide information resources that help families improve their living standards. Via various small grants, the organization set up a small telecenter with a wireless network. The center came about mainly through trial-and-error experimentation by a self-taught technologist, and it receives no third-party funds. The process of learning by doing, without active assistance, led to a deeper understanding about self-sufficiency.

The second case study looks at Sengerema, a donor-led rural telecenter in northeastern Tanzania that is housed in a purpose-built building boasting a conference room, a server room, an e-training lab, an Internet cafe, offices, and a learning room. While it is, according to the author, sustainable in general terms, it relies on continual third-party funding. The report concludes that, although both case models are valuable, the FADECO entrepreneurial approach has the potential to be vastly more scalable. But there has been little emphasis on the economic design of this type of telecenter. The development of institutions to support such enterprises could lead to much better, and more truly sustainable, rural ICT development.

*Unbounded Possibilities: Observations on Sustaining Information and Communication Technology (ICT) in Africa* Ian Douglas Howard, October 2008, APC
2.4.3 Financing and revenue models to ensure affordable and accessible pricing

Several factors, such as low population density, low income and high operating costs, have been identified as challenges in sustaining community ICT programmes. The most commonly underestimated community ICT center costs are related to staff training, security (physical and data security), and the costs of updating and maintaining equipment. The forward-looking community ICT center needs to consider how best to balance its capital costs and its revenue potential, while ensuring affordability for its users.

Financing a community ICT center can be achieved through in-kind contributions and/or funds and revenue. Revenue and financing may be a composite of the following:

- **Subsidies** - Governments may decide to subsidize (fully or partially) a community ICT center, particularly in poor areas with vulnerable population groups, who cannot afford to pay user fees. The government's initiative may be needed to launch the process, establish the legal and institutional framework, start up pilot projects, and develop national or regional support. As the idea proves itself, the government may be able to reduce its support role to a support function.
• **Donations/grants** - Public and private institutions, as well as national and international organizations, can provide donations or grants to ICT projects

• **Pay-for-use services** - The provision of other services or products in the community ICT center may also generate resources to pay their costs. In some cases, revenue comes mainly from the sale of computer and Internet time; in others, from telephony, photocopying, and entertainment. Other potentially important sources of revenue are providing domestic and international telephone service and retailing phone cards. Whether or not user fees should be collected will depend on several factors, and the question should be decided on a case-by-case basis. A minimal fee to attend a training course often motivates people to attend and benefit from the course more than when it is free. However, in certain circumstances even a minimal fee can be unaffordable for poor women and girls, acting as a disincentive to attendance.

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**Fact of interest: a cost-sharing model in Uganda**

In Uganda, a nation-wide, school-based telecenter (SBT) network, established by World Links through support from the Bill and Melinda Gates Foundation, involves 15 SBTs. Of these, 11 use Very Small Aperture Terminal (VSAT) satellite technology to link the Internet with at least eight computers on a Local Area Network (LAN). The cost is accordingly shared among the schools, through a payment of USD 200 per month. (World Links is contributing the other USD 200 per month, per site for a two-year period). Lowering the student user cost is one of the principal objectives. The schools raise funds by charging students term tuition fees and other community user fees. On average, each student pays USD 18 per year. A typical secondary school has between 800 and 1,000 students a year. In-kind contributions could include:

- **ICT hardware**, including technical maintenance and renewal;
- **Training for managerial and technical staff**. One of the core objectives in setting up an ICT community center is for it to be managed by local people. Therefore, contributions that seek to train the trainers and the center’s administrators are both useful and necessary.
- **Content**. Production of content is generally costly and may be time-consuming. However, replicating and delivering content can be done at a relatively low cost.
• **Location and infrastructure.** It is important to choose a location and ICT infrastructure for the ICT community center that takes into account women’s and girls’ constraints. For example, a school can offer a computer lab or a room for installing the ICT devices to be used by the center.

• **Tax incentives.** Governments can provide tax incentives to enterprises or persons that create an ICT community center and provide ICT courses aimed at women’s and girls’ empowerment. Governments can also give tax exemptions on ICT equipment provided to schools.

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**Fact of interest: rural innovation fund in India**

Telecenter.org and Microsoft India jointly launched the Mission 2007 Rural Innovation Fund, with an objective of empowering the local software industry by promoting individual or organizational endeavours toward developing low-cost, innovative applications, customized to the needs of local community leaders. A committee set up under the Grameen Gyan Abhiyan initiative of MSSRF, which includes representatives from industry, academia and government, manages the fund.

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22See for example an online database managed by the Educational Software Selector (EPIE Institute). This searchable database includes reviews of 19,000 instructional software packages which can be searched by computer type, subject, grade level, the teaching/learning approach used, key works and price, at [http://www.epie.org/epie_tess.htm](http://www.epie.org/epie_tess.htm). Materials have also been developed by the Commonwealth of Learning – see [http://www.col.org/resources/publications/Pages/listing.aspx?CID=9](http://www.col.org/resources/publications/Pages/listing.aspx?CID=9)

2.4.4 A note on gender-sensitive user fees

Calculating how much community members are able to spend on telecommunication services is very context-specific. Cost can be a major deterrent in access to ICTs. An overall policy framework that addresses the needs of those who would find the costs difficult to bear might include the following considerations:

- Recognize wage/income gaps in setting user fee rates, both in terms of gender as well as geographic area (rural, urban);
- Promote consumer/user-focused pricing policies for specific services and community oriented programs, such as:
  - Universal access/service obligations for carriers to provide affordable services,
  - Discounted tariff prices for telecenter-type service providers,
  - Regulatory frameworks that provide affordable prices for all users, including:
    - Price competition among ICT service providers,
    - Incentive programs to increase access (e.g., telecommunication development funds, which can be used to subsidize costs),
- Develop interim strategies to build membership fees or sliding-scale fee structures.

2.5 Links to reference materials

Connecting the first mile: a framework for best practice in ICT projects for knowledge sharing in development

GEM: Gender Evaluation Methodology for Women and ICTs - A Learning Tool for Change and Empowerment

International Taskforce for Women and ICTs

Wikibook: Gender and ICT

AFRICAN WOMEN AND ICTs: Investigating Technology, Gender and Empowerment
3 Meeting the learning needs of women: using ICTs in literacy and life-long learning

There are at least two main dimensions to ICTs and literacy. One dimension revolves around the teaching of such basic skills as reading, writing and counting to the “illiterate.” ICTs can be applied to produce interactive and audio-visual curriculum materials for use in classrooms and to assist in classroom teaching and distance learning.

The second dimension involves functional digital literacy as an ingredient of socio-economic development. Here, technology is put into the hands of learners to use and adapt, and to formulate applications that are meaningful in the context of their daily lives.

This chapter looks at both dimensions. Starting with digital literacy, the chapter showcases initiatives that bring technology training directly to women, and then discusses how this impacts on their socio-economic empowerment. It then looks at ICTs as tools for delivering basic literacy programmes. Both dimensions are equally important and often go hand-in-hand. This is, more often than not, the reality of capacity-building and training for women.

The recognition that ICTs can be used to supplement and complement the conventional education system needs to take hold in a more systemic and extensive way in order for these ICTs to become the tools of choice for learning and teaching. Rather than regarding ICTs as add-ons, policy formulation needs to integrate ICTs into a range of adult literacy programs. An adult literacy policy will need to address two fundamental aspects in order to fully engage women:

- A rights-based approach to literacy – This will have major positive implications for women, promoting women’s empowerment and capacity; and
- A poverty-focused approach to literacy – Since the problem of illiteracy is inextricably linked to that of poverty, it requires mainstreaming literacy across all sectors, ministries and agencies that address poverty issues.
3.1 Basic ICT literacy for women: learning by doing

Learning the fundamentals of keyboard and browser use can open the door to an infinite range of learning experiences. Deliberate and dedicated programs that cater to first-time adult users, especially women, need to be designed, supported and delivered to enable this constituency of users to step over the digital threshold. Often, the simple functions of receiving and sending emails, using a search engine and reading web content are the starter blocks to training in ICT use. Demonstrating the usefulness of being ICT-literate in the context of their lives will create an incentive for women to participate actively and to use their newly acquired skills.

Content example: Computer Driving License in the Arab Region

The UNESCO Cairo office is the licensee for the International Computer Driving License (ICDL) in eight counties in the Arab region: Egypt, Lebanon, Libya, Jordan, Palestine, Sudan, Syria and Yemen. ICDL is an international version of the European Computer Driving License (ECDL) for use outside the EU countries. The programme covers the key concepts of computing, their practical applications, and their use in the workplace and society. It consists of seven modules, each of which must be passed before the ECDL/ICDL certificate is awarded. The modules are: Basic concepts of information technology; Using the computer and managing files; Word-processing; Spreadsheets; Databases; Presentations; and Information and Communication.

In preparing an ICT course, it is important to:

• Learn about women’s specific needs within the community. If there are several women’s groups with different needs, courses should reflect this. When planning training, engage with women in the community to get their views and conduct a needs survey;
• Include exercises so that each woman or girl can practice them in the telecenter or computer center, in their own time;
• Choose context-relevant examples and exercises that apply to the realities that the women are dealing with on a daily basis;
• Collaborate jointly with women’s institutions and organizations and other mainstream training institutions.
In many cultures, education in science and technology is often perceived to be a male domain. Training in ICT skills is rarely gender-sensitive or tailored to women’s needs, and may be delivered by a male trainer who has embedded perceptions about women’s capabilities that are inconsistent with a research-based understanding of women’s competencies and contributions in these fields. Training and supporting a network of women trainers is one way to redress these preconceptions.

Content example: Basic Internet Literacy Training, Bato, Philippines

The Basic Internet Literacy training, a course developed by the International Telecommunication Union (ITU) and the Asia-Pacific Women’s Information Network Center (APWINC) for the "Development and Delivery of ICT Training Tools for the Promotion of Livelihood of Women in Rural Areas" project, is conducting its pilot in Bato’s Leyte Community eCenter. Participating in this training are the community’s womenfolk of all ages. The Basic Internet Literacy course will be followed by a customized training focusing on the participants’ utilization of available information from the World Wide Web. The courses focus on the basic use of social networking applications by rural women of the community, in particular those used to support farming and small agricultural businesses. See http://www.connectaschool.org/itu-training/3/159/en/Training_Remote_Rural_Users_ICT_Economic_Activities_Education_Government_Services/Basic_ICT_Literacy for training materials.


3.2 Links between digital literacy and women’s socio-economic empowerment

In the hands of women, ICTs can be a source of greater autonomy and self-determination, which are often missing in women’s lives. In other words, with access to information and communication channels, women may gain more say over the decisions that affect their lives. This represents a
significant form of empowerment. Being ICT-literate can generate a positive impact for women in many spheres, including:

- **Education and life-long learning:** ICTs serve as a teaching aid and a tool for developing skills. Women can access basic and advanced education courses and life-long learning, as well as different training courses via the Internet. Women can access books, articles and general information in e-libraries and on the Web, and are able to get in touch with others to perform joint projects regardless of physical location.

- **Information services:** Women can access information that is important to nearly every activity they do, ranging from health care to small business management. If they need information concerning how to price their products to get better prices or weather forecast data, for example, they can learn how to obtain it from reliable sources. This can contribute to women and their families having longer and healthier lives.

- **Communication and networking:** In many countries, women entrepreneurs are often social entrepreneurs first and foremost. Their business motives are driven less by profit than by a need or desire to earn income so they can provide for the health and welfare of their immediate families and communities. The majority of small-scale women entrepreneurs often bear several community responsibilities beyond the immediate household -- for instance, in the local orphanage, the local faith institution, environmental awareness groups, information and advocacy groups. These women need to build on existing modes of networking to extend their reach out to business intermediary agencies and wider markets, and to engage their competitors, in order to secure their business livelihoods. This means that women need a range of support provision to connect the big picture with their business objectives, to draw on leadership resources for effective execution, and to connect strategic communication and networking with implementation. When women are ICT-literate, they can participate in online social networks, keep in touch with family members and friends, and organize and advocate for their rights through civil society movements.

- **Indigenous knowledge, values and culture:** Women can transmit their own cultural values and traditions through ICTs, and so preserve their cultural heritage. They can produce Web content in their mother tongue and put it online. Migrant women can stay in touch and establish links with their home communities. Women can also access museums, listen to concerts, and watch cultural programmes through ICTs. ICTs have also played an important role in preserving and identifying threatened or marginalized cultural artefacts and traditions. Visitors to
http://www.maori.culture.co.nz/ for instance, can read histories of the Maori people, view images of cultural artefacts and the unique tattoo patterns common among Maori men, obtain Maori recipes, and order cultural products from an online shop. Communities have a wealth of indigenous knowledge that remains “untapped” and unshared. This knowledge is passed on from generation to generation by word of mouth and is not documented. Involvement of communities from project inception and in content generation can lead to sharing of the indigenous knowledge and its fusion with scientific knowledge to tackle practical problems those communities. Community involvement in this regard has an added benefit; indigenous communities take responsibility and shared ownership of the content development process.25

- **Access to job opportunities:** ICTs open a wide range of opportunities for increasing women’s income. Women with ICT skills will have more opportunities to find interesting and well-paid employment. Also, ICTs can be used to buy and sell products. Additionally, women can work from home using ICTs, which can reduce time constraints in women’s daily agendas.
- **Political participation:** ICTs provide women with information on government activities, political parties and candidates for public office. When women can freely access information regarding their communities and government actions, they can more easily participate fully in the political process.
- **Human rights:** Women and men with basic ICT skills can more readily (and if they wish, anonymously) report on human rights violations. With the use of ICTs, the international community has become more aware of the abuse of women’s basic human rights.

**Content example: Using ICTs to empower fisherwomen in reef conservation and management, Southeastern India**

To reduce pressure on coral reef resources and lessen the economic vulnerability of coastal communities, local fisherwomen Self Help Groups (SHGs) have been empowered through the provision of ICTs and adult education in five coastal villages in the Tuticorin district of the Gulf of Mannar (GoM) in south-eastern India. Improved literacy levels, environmental education, and computer training and equipment have enhanced villagers’ ability to take up alternative livelihoods and improve their living conditions.

The project demonstrated SHGs’ potential as a non-threatening mechanism for mobilizing resources and providing affordable finance and social benefits to poorer fisherwomen. The SHGs also promote self-reliance, awareness creation, capacity development, social solidarity and empowerment. Village
coordinators from five targeted villages were trained, and each village was provided with a computer, printer, mobile phone, and internet access. The SHG members in the targeted villages were also trained in other alternative livelihood activities such as vermi-composting and hygienic fish drying methods.

The creation of awareness about the environment, along with the adult education, computer training and other livelihood options, helped the fisherwomen to earn additional income for their families. It was also a key factor in reducing destructive fishing practices and enhancing living conditions in the coastal areas of GoM.

Source: http://www.nova.edu/ncri/11icrs/proceedings/files/m23-15.pdf?

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3.3 Using ICTs to promote literacy training among women

Broad trends in the use of ICTs in literacy programs are emerging from recent research and country studies commissioned by UNESCO. These studies indicate that:

- Many countries do not use ICTs in literacy programs, nor have they formulated policies for the integration of ICTs into adult literacy programs;
- Many countries face challenges with regard to financial resources and a lack of technological infrastructure;
- Where ICTs are used, they are typically basic ones such as radio and television. When computers or the Internet are involved, they tend to be restricted to targeted users;
• There is a relatively greater use of ICTs in school education. The use of ICTs in community learning centers is still limited;
• Most ICT projects for adult literacy are pilot projects that are often funded by international agencies and have not addressed methods to promote sustainability;
• Little attention has been paid to gender issues. There is no effort to address issues of access, content and the impact of technology on women.\textsuperscript{26}

Fact of interest: Who are the illiterate?

Many people are insufficiently literate; they lack the written skills for expression and comprehension that enable them to learn. Some people lack literacy skills because they had no means to attend school or because schooling was cut short or was of poor quality. These people are almost all poor, almost all live in low-income households in developing countries, and many belong to linguistic and cultural minority groups. In most countries, access to education continues to be a greater barrier for women than for men; an estimated two-thirds of the world’s illiterate persons are women.\textsuperscript{27}

Traditional literacy programmes face many challenges, including:

• High costs,
• Shortage of teachers,
• High drop-out rates due to lack of motivation,
• A lack of access to training materials, and
• Long periods of time required to achieve literacy goals.

Computer-assisted learning can offer the digital learner many advantages, including the use of computer games and interactive activities that make learning easy and attractive. Digital content developed in local languages can be downloaded and accessed by learners at a time that suits them best. Similarly, by presenting reading lessons and numeracy education in a game form, computer programs encourage learners to compete against themselves and engage in repetition and practice without losing interest. Such computer programs repeat words and correct errors for large numbers of students at the same time, thereby reducing pressure on overworked teachers. There is a huge potential for ICT applications to promote literacy and numeracy around the world. In particular, ICTs can be enlisted to overcome the many obstacles outlined above by fitting into people’s lives flexibly. The utilization of ICTs to promote literacy and numeracy can take the following forms:
Radio: It can help overcome geographical barriers by facilitating distance learning, bringing literacy education to people who live in remote areas. Although radio lacks the visual element, it is nonetheless entertaining, easily accessible and affordable. Radio transmission, used in combination with printed training materials, can make literacy lessons more true-to-life and interesting. Also, local radio stations usually have close ties with the community, so they are in touch with local preferences, languages and cultures, and can tailor training accordingly. One clear disadvantage of using radios (and indeed television) in literacy education is that programmes are usually broadcast at fixed schedules over which learners have no control. Consequently, learners are not able to learn at their own pace and convenience.

Fact of Interest: Community radio – an empowering tool in the rural context, Mozambique

Local community radio stations that broadcast from telecenters are certainly the most used ICTs for all the women interviewed in this study. Radio broadcasts are free to the listener, and access does not depend on having electricity or individual radio ownership. People listen together in public places and at home. Running costs are generally low, making the radio the most affordable ICT in rural areas, particularly where wind-up radios are available.

There are, however, people who cannot afford to own a radio. For example, a head of household in Manhiça said she never used any technologies, and she wouldn’t like to have a radio or a telephone since they meant more costs. "Radio batteries are expensive," she said. She wanted only to have something to eat every day. When we interviewed her, she was at the telecenter to collect her lost identity card; someone had found it and taken it to the telecenter, and an announcement was made on the radio. The woman’s neighbours heard it and told her. Without the radio to act as a trusted central point she would not have discovered where her card was.

About 95 per cent of the interviewees confirmed that they listened to radio, and many told us that they know the programme schedules. The most popular programmes are the public information announcements, especially death notices. In these women’s socio-cultural context, participating in the mourning of community members and relatives is an essential part of the fabric of society, and the radio is the fastest and most economical way of reaching a large number of people. News programmes and special programmes for women were also popular. News programmes enabled the
women to acquire information that reduced their isolation, both within their communities and nationally and internationally. The women’s programmes, meanwhile, covered a range of topics, such as the behaviour of adolescents within the family, safety precautions to be taken in the home, HIV/AIDS, cooking, children’s health and social behaviours.

**Television:** This medium matches words with images and provides movement and animation in combination with audio, and consequently:

- Facilitates practicing reading comprehension;
- Is more entertaining and thereby motivates the target audience to watch and learn;
- Provides a means by which to stimulate discussion and critical thinking; and
- Facilitates dissemination of literacy materials with audio-visual features.

**Audio Cassettes, CD ROMs, DVD, VCDs:** These media have many of the same advantages as radio and television. However, one clear advantage is that literacy courses can be accessed at a time and frequency that can be controlled by learners. Moreover, these forms of ICTs can be utilized at home, which helps to overcome social, cultural, financial and logistical constraints that many learners may face in terms of attending literacy classes.

CD-ROMs, in particular, offer:

- A cost-effective medium through which literacy content can be disseminated easily and cheaply;
- An interesting and entertaining resource for reading and writing classes; and
- The concentration of high volumes of information in a light, small package, as opposed to cumbersome text books.

**Digital Cameras:** They can be used to create local content, and in particular, to use local images in literacy classes. Techniques could involve:

- Giving learners more control over the content by letting them collect photos and developing literacy lessons with these materials;
- Matching words (in the local language) with images they have collected using digital cameras; and
• Sequencing pictures in order to make learners create sentences and stories, thereby further
developing their literacy skills.

Mobiles and SMS Technology (texting): Mobile phones, and in particular Short Message Service (SMS)
technology, have become part of day-to-day life in developing and developed countries alike.
Unfortunately, they also serve as an ongoing reminder to illiterate people of their illiteracy. This can,
however, be a motivation for people to overcome that illiteracy. Moreover, for new learners, regularly
using dial pads and sending text messages will serve to reinforce their newly acquired literacy and
numerator skills.

Computer Based Training: The Internet offers a wealth of digital content that is accessible to learners
to use at their convenience. Moreover, the dynamic nature of the Internet empowers women because,
unlike older technologies such as TV and radio, the Internet is interactive; it transforms users from
passive viewers into active participants. With chat rooms, email facilities and social networking
websites, the Internet encourages and reinforces reading and writing skills.

Through the Internet, women can transform their stay-at-home status into a learning activity, and can
use the Internet as a tool to practice their newly found literacy skills, by:

• Utilizing it as a platform to develop additional business skills, become career literate, make
  business transactions, and earn money;
• Conducting day-to-day activities with the use of online applications (e.g. reaching government
  services, submitting job applications, paying bills etc); and by
• Benefiting from social networking sites.

Content Example: The Commonwealth of Learning Literacy Project (COLLIT)
The Commonwealth of Learning (COL) received support from the UK’s Department of International
Development (DFID) to undertake a pilot project in Zambia and India to explore ways by which
literacy programmes might be enhanced through the use of appropriate technologies. The three-year
pilot project, which began in July 1999, was implemented through the “technology-based community
learning center” model. The concept of a community-based learning center includes deploying various
types of ICT equipment that will be managed and accessed by members of the community. It also
calls for learning to be facilitated and provides a place where locally relevant learning materials can
be developed. All of this was a central ingredient in the COLLIT project.
The impact of the project was most visible on the people involved in operating the learning centers, most of whom had no prior exposure to computers and other ICTs. By the end of the project, the facilitators and staff at the learning centers, in both countries, emerged as well-respected ICT-trained literacy instructors with experience in using the equipment to develop locally relevant instructional materials. The COLLIT project also demonstrated that given the opportunity, learners are quite capable of using ICTs in ways that not only help them achieve educational goals, but that are also remarkably motivating and applicable to other facets of their lives.

http://www.col.org/resources/publications/consultancies/Pages/2004-09-ICT.aspx

E-learning is one way the internet can be used to combat illiteracy. The International Commission on Workforce Development\(^29\) (ICWD)\(^29\) has recognized several benefits of e-learning, namely:

- **It is non-competitive:** E-learning methodologies address learners' needs, learning styles and capabilities on an individual basis. Learners can focus on their own progress and performance and are continuously rewarded by their learning achievements. E-learning relieves learners of peer stress typically associated with classroom attendance with other learners.

- **Online training can be less intimidating than instructor-led courses:** E-learning environments are perceived as risk-free, in the sense that mistakes by learners are confined to themselves and to the system they are using. Therefore, e-learning models save learners embarrassment that they otherwise could experience in group learning environments. Moreover, e-learning systems give students the opportunity to correct their mistakes and try to improve their performance, while learning at their own pace.

- **Content is up-to-date:** E-learning systems typically enjoy content management modules that make it possible to update the content and keep it up-to-date with new learning material and courses.

- **Consistency:** E-learning systems deliver courses in the same manner each time and for each participant. Thus, learners do not need to adapt to changing teaching models and approaches. Learners focus on the core content efficiently and with minimal distractions.
• **Flexibility and ease of utilization:** E-learning requires a computer and Internet access, but with those tools, coursework can be accessed anytime, anywhere and regardless of the availability of teachers.

• **Open and Distance Learning and ICT:** Some countries, most notably Australia, the US, and South Africa, along with international organizations such as UNESCO, have developed open learning packages with literacy material. Content can be downloaded and printed out for distribution and easy use in literacy classes. Such materials could be used to supplement other ICTs, such as radio or TV broadcasting, and used by nomadic and remote communities, where illiteracy rates tend to be high, especially among women.

• **Videoconferencing and teleconferencing:** By permitting communication across large distances, videoconferencing and teleconferencing can bring literacy classes to very remote areas. Consequently, women who may not be able to travel long distances for social or financial reasons can get access to literacy classes. In this sense, these technologies serve to overcome key obstacles related to cost and convenience that typically prevent the rapid progress of illiteracy eradication.

Audio books (i.e. books that are recorded and made available on audiocassettes and CDs) can be a valuable tool in promoting literacy. They can be used in association with written texts to improve the efficiency of student comprehension and reading ability. Talking Books are, as the name suggests, electronic texts converted into spoken words. They help literacy students by enabling them to hear the words as they read them, and by providing immediate guidance on the pronunciation of specific words. Audio books can also be equipped with a system for decoding and tracking words with troublesome pronunciations. This can enable teachers to identify the words that are challenging for a particular student. In these respects, audio books are more supportive as a learning tool than electronic books.

Electronic books (e-books) are electronic texts that are made available on the Internet and on CD-ROM. They are similar to text books in that they combine text with definitions, background information, and images. The advantages of e-books are:

- It is easy to manoeuvre among book sections and chapters, as well as to examine references by following links;
- E-books can be easily modified to match the capabilities of students, such as via manipulation of font size;
• They are generally enhanced with extra, embedded resources such as definitions and other details.

Content example: The Tata Computer-based Functional Literacy Programme, India

In this programme, computers deliver the lessons in multi-media form, supplemented with textbooks. Audio voice-overs explain how letters combine to give structure and meaning to various words, and they pronounce the words. The emphasis is on words rather than alphabets. Lessons are designed to be visually stimulating and entertaining, using elements such as puppets. The lessons, which are based on material developed by the National Literacy Mission, focus on different languages and dialects.

Through the project, a number of learning centers have been established. Each center has a computer and an instructor. Because the project relies on computer programs, it has less need for highly trained teachers, which is an advantage in areas that lack teachers. A typical class has 15 to 20 people and is held in the evening hours.

Source: http://www.tataliteracy.com

Content example: ICT for Illiteracy Eradication (ICT4IE) Egypt

According to official statistics provided by the Central Agency for Public Mobilisation and Statistics (CAPMAS), the number of illiterate persons in Egypt is 17 million, with women constituting about 70 per cent of that number. The prevalence of illiteracy among women, particularly in very conservative rural and remote areas, and the demonstrated discomfort among many older students in traditional illiteracy eradication classrooms, gave rise to the idea of mobilizing multimedia technology. An educational CD set consists of three CDs; two for illiteracy eradication and a CD that provides an orientation course for preparatory-level schooling. The set can be used in the privacy of the trainee’s home, in a community development center, or at an NGO office.

(See: http://www.youtube.com/watch?v=avtrTyZ_-_HE)?

The CD course is similar to the GALAE (General Authority for Learning and Adult Education) official course, which enables the students to enter the GALAE exams and become IE certified. The multimedia course duration is four months (compared with 10 months for the traditional course). One of the target groups comprises rural women and women in deprived areas. Due to social customs and
traditions, some women remain unreached, since they are not allowed to leave home to attend illiteracy classes.

To overcome this obstacle, innovative solutions that recognize local norms were developed. One tool, called a "Tabluter," was based on the traditional wooden table known as the tablya. It is a customized, ergonomic, embedded computer on a table. The embedded computer is a single Central Processing Unit that runs for four independent users. Each user is equipped with his/her own screen, keyboard, mouse and sound card. The Tabluter is situated in an individual home where IT classes and illiteracy eradication classes are being held, thus reaching those women who are not allowed to leave the homestead.

26 See UNESCO Bangkok. "ICT and Literacy." ICT in Education. 2007 for further information, country research studies were conducted in China, Bangladesh, India, Pakistan, Egypt, Mexico and Brazil. http://www.unescobkk.org/education/ict/online-resources/features/ict-and-literacy

27 Source: http://unesdoc.unesco.org/images/0015/001529/152921e.pdf


29 http://www.icwfd.org

http://www.i4donline.net/articles/current-article.asp?Title=Effective-Practicesfor-Engendering-the-Digital-Divide,-Egypt&articleid=2322&typ=Features
3.4 Language literacy and women’s empowerment –
drawing the links

Illiteracy inhibits human development, and its eradication is the cornerstone of any developmental process for women and men of all ages. The term illiteracy primarily means the inability of a person to read or write. Improving adult literacy levels by 50 per cent by 2015, especially among women, was set as one of the objectives of the UNESCO Education World Forum in Dakar in 2000.\(^{31}\)

Women constitute an estimated two-thirds of the world’s illiterate population. Illiteracy is a major obstacle to women’s empowerment. The negative impact of illiteracy is manifested in the huge divide between literate and illiterate women in almost every aspect of life: personal and family, health status, social life, economic life and political life. Conversely, literacy programmes can have a very positive impact on the personal, family, community, social and political lives of poor women.

Literacy programmes that combine literacy with basic business skills can be an effective way to keep a programme relevant to women’s day-to-day lives. Literacy is important for social development, both in terms of inputs and outputs. Literate adults are more capable of understanding and upholding human rights when they can better participate in democracy and political processes. At least one study links literacy with reduced family size. That is, by enabling women to use contraception more effectively, literacy empowers them to control their sexual lives.\(^{32}\)

Language literacy makes a difference in a woman’s life and, consequently, in the life of her family -- especially when it comes to health issues.\(^{33}\) Women who can read are more motivated to participate in the election process, whether as an electoral candidate, a team member of a candidate, or as a voter. There are a number of practical examples of communities becoming more economically and socially engaged once they became literate:

- The Vagla Community in northern Ghana began to see an increase in involvement in the political affairs of the community.
- The Bimoba, also in Ghana, began to organize into cooperatives and to do long-term economic planning.
- The Pez of Colombia have organized their own education committee to do long-term educational planning.
• In the Philippines, newly literate women utilized their literacy skills in opening bank accounts and managing their money more knowledgeably.
• In India, newly literate women qualify for desirable jobs.

Illiterate women are keen to become literate and acquire ICT skills. A study conducted with 40 women (IKRAA participants, see project IKRAA in case studies) with newly acquired literacy skills found that illiterate women were keen to acquire literacy skills for many reasons:

• For their own self esteem. Literacy meant that they would be become the equals of their husbands and even their children;
• In order to access the Internet. They felt left out of a whole new world that they knew existed but could not access;
• In order to be able to read and send text messages;
• To feel empowered by becoming literate. It meant that they could read signs and find their way, and they could sign their names on government or business documents and acquire jobs;
• To feel more in control of their future.

UNESCO recognizes that "an educated person is better equipped to handle all of life's challenges, from finding work to avoiding diseases." When an illiterate woman becomes literate, the potential for positive individual and social transformation grows dynamically. Such women subsequently improve their job and employment opportunities and are empowered in their communities.

The negative impact of illiteracy on the families of illiterate women is also a key consideration. Families of illiterate women are caught up in a generational cycle of underdevelopment, in terms of lack of education, poor health and poverty.

Adult literacy programmes in a woman’s “mother tongue” can begin to break that cycle. Moreover, once literate, women can move on to access other educational opportunities. This is especially true among the rural poor, who have some of the highest illiteracy rates.

Newly literate mothers:

• Express motivation to learn more;
• Show a tendency to seek and take jobs that require literacy skills and that were not previously available to them, enabling them to better support their families;
• Convey the importance of literacy to their children, motivating them to seriously pursue their education;
• Become role models for other women to seek literacy lessons and skills.

Literacy has also proved to have positive implications for women’s economic status. Being literate enables women:

• To make wiser economic decisions concerning their daily lives;
• To undertake simple business activities taken for granted by many literate? people; and
• To increase their self-esteem and confidence in their business transactions.

32 http://www.sil.org/literacy/wom_lit.htm
33 A report on Literacy & Women’s Health by the NGO Proliteracy Worldwide http://www.proliteracy.org/NetCommunity/Document.Doc?id=36 concludes as a result of working with one million women on literacy eradication programs in USA, and 48 developing countries in Africa, Asia and Latin America, that high rates of literacy are typically found in regions that demonstrates high rates of infant mortality, low age expectancy and poor nutrition.
34 Literacy Initiative for Empowerment (LIFE) 2006 – 2015, UNESCO 2007, p.3
http://unesdoc.unesco.org/images/0015/001529/152921e.pdf
35 For more details, see the UNESCO 2005 advocacy brief for Mother Tongue-based Teaching and Education for Girls and Women: http://unesdoc.unesco.org/images/0014/001420/142079e.pdf . See also UNESCO Report 2007 on Mother Tongue-based literacy Programmes in Asia Region:
http://unesdoc.unesco.org/images/0015/001517/151793e.pdf
3.5 Numeracy and financial literacy

Numeracy tends to play second fiddle to literacy. The eradication of innumeracy among women is essential for many reasons, most important of which is the link between numeracy and broader financial literacy. The latter is an important skill set for people to make sound decisions, both short- and long-term, regarding their economic security.

- Without numeracy skills, women cannot start their own businesses (even from home), because even basic business activities require numerical skills;
- Innumeracy rules women out of most well-paying employment opportunities;
- Women are unlikely to open a bank account, because any banking relationship that involves credit, savings and loans requires the ability to undertake simple calculations;
- Mothers will pass on their values to their children, including whether they believe literacy and numeracy are important. Studies show that financial literacy is often a learned behaviour, and there is a clear role for parents to play in making their children comfortable with these issues;
- Women are often the accountants of households, putting them in charge of daily financial management, including paying for basic goods and services, such as groceries, electricity and water. Without numeracy skills, they cannot manage this role effectively;
- Women without numeracy skills are vulnerable to fraud and can be cheated more easily.

Mathematics is an integral component of any education curriculum. Numeracy is the precursor to mathematics, and acquiring it is essential to any illiteracy eradication effort. The next section examines a range of practical applications.

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Content example: UNESCO Literacy numeracy program

UNESCO has integrated its literacy and numeracy programmes for adult learning around the world. For example, in Cape Verde the project, “Training for the Design and Implementation of an Integrated Adult Distance Learning and Training System (ECCA System) for the Economic Development of Cape Verde and Related Curricular Design” (2006-2009) is jointly financed by the Government of Cape Verde, the Regional Government of the Canary Islands and the Spanish Agency for...
International Cooperation. It is a follow-up of the project “Adult Distance Learning (ECCA System) for the Economic Development of Cape Verde” (2002-2005). These projects were set up in support of the National Programme of Adult Education and Training, which combines distance education with adult basic education, secondary education, vocational education, and training, as well as community learning for development.  

For more on the importance of numeracy, see: 

http://www.unesco.orgUIL/literacyprogrammes/programmes.html
http://www.planotes.org/documents/plan_03225.PDF

4 Beyond literacy: ICT applications that support women’s entrepreneurial and professional activities

For the 60% of women employed in agriculture in South Asia, access to quality education, skills training and entrepreneurship development tools not only represents a way out of poverty, but also provides them with opportunities of empowerment in the world of technology. As a child, Shantabai dreamed of becoming a professional photographer. Born in a large family of marginal farmers, Shantabai had only an elementary education in her village school before she was married off at the age of 13. Besides working on her husband’s family’s small piece of land, she had to care for her children and her husband’s elderly parents.

She enrolled in several training courses with Srujan, a partner organisation of the ILO’s Workers Activities programme (ACTRAV). These training courses, of which several were digital, not only provided her with new skills but also motivated her to seek new opportunities to enhance her income. One such training course Shantabai participated in was on photography skills, and she decided to...
make it her profession. Through the process, Shantabai became an inspiration for many women in her own village and in neighbouring communities.

ICTs have been shown to be deeply interconnected with improving social, economic and political engagement and development. ICTs can empower women and girls by increasing their direct access to information, education and services. Communication technologies also increase opportunities to connect and find a stronger voice – not only in the local community, but potentially to influence the world. ICTs help to ensure that the ideas and perspectives of both women and girls are heard and taken into account by decision-makers. This includes access at school, which is why a number of projects focus on girls’ access to computers and the Internet, teaching girls the skills they need to use technology in the wider world. While a range of school networking projects promoting access to ICTs in schools have been rolled out in a number of African countries, not all have a gender perspective. Recognizing this fact, SchoolNet Uganda has selected girls-only schools in which to install computer labs.

**Fact of interest - Gender and telecommunications in Bangladesh**

An evaluation of the Grameenphone Village Phone programme in Bangladesh found that women operators of the village telephone were not only provided with a profitable business opportunity, they were also given more comfortable and equitable access to telephone service (Richardson, 2000, p. 31). Village Phone operators gained increased social status within their own villages as a result of three factors: (1) their increased income; (2) the fact that wealthier women came to use the telephones of women who were less wealthy; and (3) the fact that the woman’s house now became the center of local activity in the village.

Ways in which ICTs can contribute to women’s economic empowerment include:

- An increased ability for women to work from home;
- Improved employment opportunities for women in the IT sector;
- Increased ability of informal-sector women to find formal employment;
- Improved global market access for craftswomen through e-commerce;
• Transformation of traditional gender roles;
• Improved access of women, especially rural women, to distance learning and distance work programs;
• Improved ability for sharing of experiences among women's organizations concerned with the economic well-being of women in the informal sector; and
• Increased ability to avoid gender bias by having a gender-opaque medium.

Apart from digitized information and learning channels, one significant development for women’s empowerment is in the small business development and market access sector. The Internet acts mainly as a mechanism that reduces the cost of acquiring information about products and prices. This section outlines the ways in which ICTs have been applied to women’s empowerment objectives. It offers policy-makers examples of training content, ICTs in the marketplace and new opportunities for women working in the ICT sector and related fields (see box).

**Fact of interest: the ICT sector defined**

*How is ICT-assisted instruction defined?*

ICT-assisted instruction refers to teaching methods or models of instruction delivery that employ ICT in supporting, enhancing and enabling course-content delivery. It includes any, all or combinations of the following: radio-, television-, computer- and Internet-assisted instruction.

*What are ICT-related fields?*

ICT-related fields include all programmes that include any of the following four fields of education and training:

*Audiovisual techniques and media production* is the study of techniques and the acquisition of skills to produce books, newspapers, radio or television programmes, films or videos, recorded music and graphic reproduction using ICTs. It includes programmes in methods of colour reproduction, photography and computer graphics, as well as the layout for pictures, words and decorations in the production of books, magazines, posters, advertisements, etc.
**Computer science** is the study of the design and development of computer systems and computing environments. It includes the study of the design, maintenance and integration of software applications.

**Computer use** is the study of using computers and computer software and applications for different purposes. These programmes are generally of short duration.

**Electronics and automation** (engineering and engineering trades) is the study of planning, designing, developing, maintaining and monitoring electronic equipment, machinery and systems. It includes designing computers and equipment for communication.

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39 Shafika Isaacs 'IT's Hot for Girls! ICTs as an instrument in advancing girls' and women’s capabilities in school education in Africa', United Nations Division for the Advancement of Women Expert Group Meeting on “Information and Communication Technologies and their impact on and use as an instrument forth advancement and empowerment of women” Seoul, Republic of Korea, November 2002

4.1 Access to information and training – from rural to national

ICTs have multiple roles in training, capacity-building, learning by doing and community-building, all of which can be provided through community ICT centers. A variety of tools provide an effective and efficient means to deliver informal training courses, more sophisticated qualification-driven learning, learning by communicating with others, or from reaching out to see what others are doing. As management expert and author Peter Drucker wrote, learning is a life-long process of keeping abreast of change, and one of the most pressing tasks is to teach people how to learn.

One interesting example of formal e-training is the ongoing qualifications provided by the African Medical Research Foundation’s (AMREF’s) virtual nursing school, which serves thousands of nurses across Kenya. As of 2008, e-Learning became the preferred mode due to its interactivity, cost effectiveness, ease of revision and ability to achieve the goal in less time and at a lower cost than the residential programme. It also enabled continued service provision, instant application of learning and improved quality of care. The second example (Maarifa) exemplifies the multi-layered nature of using ICTs for learning.

Content example: Health qualifications for nurses in Kenya (hyperlink)

In July 2008, the Kenyatta National Hospital and AMREF\(^{41}\) signed a memorandum of understanding to support an effort to upgrade the certification of 500 Enrolled Nurses to Registered Community Health Nurses, through AMREF’s Virtual Nursing School (AVNS). AMREF committed to training the nurses over the following five years, using computer-based training modules. The nurses would upgrade their skills while continuing to work, using a supervised e-course that blended theory with clinical experience at one of the more than 100 computer-equipped training centers in eight provinces.
These centers covered several rural, remote and marginalized districts (e.g. Garissa and Dadaab refugee camps in the North Eastern Province of Kenya).

This is a public-private partnership with the Nursing Council of Kenya (NCK), AMREF, Accenture, the Kenya Medical Training Colleges, several private and faith-based nursing schools and the Ministry of Health, all collaborating in delivering a country-wide eLearning programme for nurses. The programme commenced in September 2005 with four schools and 145 students aiming to upgrade 22,000 Enrolled Community Health Nurses (KECHN) from "enrolled" to “registered” level within five years. Enrolled Nurses (ENs) comprise 70 per cent of the nursing workforce and 45 per cent of the health workforce in Kenya. They are the first point of contact for communities, but are inadequately skilled to manage new and re-emerging diseases like HIV/AIDS. This has necessitated continuing professional development to improve nursing care standards in line with health-related Millennium Development Goals (4, 5, and 6) and enable them to respond effectively to disease diversity and complexity.

Building on its success, in April 2010, AMREF, the University of California in Los Angeles (UCLA) and Johnson and Johnson (J&J) launched an e-learning programme to enhance the management capacities of HIV and AIDS organisations in Kenya. In partnership with Kenya’s National AIDS Control Council (NACC), the programme will be used to build the capacities of 7,000 NACC managers in effective health leadership and management.
Content example: Farming and rural empowerment in East Africa

Initiated in 2007, the Maarifa Centers (Maarifa is the Swahili word for knowledge) are a project by Arid Lands Information Network (ALIN), an organization that aims to facilitate the exchange of ideas, experiences, and knowledge among communities to enhance learning for improved socio-economic empowerment through multi-media tools. The project involves the establishment of community knowledge centers (CKC) in the rural areas of Kenya, Tanzania, and Uganda that, in partnership with other agencies, seek to bring ICTs to rural communities to enable their documentation and sharing of local knowledge - in particular, knowledge relating to farming and natural resource management.

There are 10 Maarifa Centers, eight in Kenya, one in Tanzania, and one in Uganda. The centers have been established to increase access to information on the part of rural communities, enabling them to turn their experiences into knowledge and lessons learned. Each center is equipped with basic ICT tools (computers and Internet access) to enable information generation, access, and dissemination. The centers have a resource area containing materials such as newspapers, journals, books, research reports, electronically stored information (CD-ROMs), audiovisual materials (DVDs), compendiums, and all types of web-based resources. At the Maarifa Centers, community members can access and share information on how to improve their livelihoods through new technologies for farming, livestock keeping, coping with environment and climate change, and current marketing information. The centers also offer information related to health, gender, and HIV and AIDS.

The centers offer basic ICT training to community members, many of them young people who have graduated from secondary schools, as well as primary school pupils, many of whom have formed information clubs. The centers also act as information access points for community development workers who provide agricultural and related extension services in the region. They use the centers to acquire free (online) development information and to send weekly reports to their ministries or
organizations, but also benefit from basic office services such as typing, photocopying, and free Internet access.

A typical Maarifa Center is managed by a selected advisory committee of about 5-8 members drawn from local community stakeholders. According to ALIN, the selection process ensures that the membership is gender-balanced, represents interests of special groups, and has diverse background. ALIN’s volunteer programme supports the running of the centers. The volunteers work at the center for one year and are supervised by local host partner organizations. They are generally young graduates in mass communication, agriculture, environmental studies, or community development. The volunteers manage the center’s activities, coordinating the collection of development-oriented local knowledge and experiences and training local communities on the use of ICT tools. The Maarifa Centers also support the active involvement of women. In order to enhance the capacity of women to play an active role in development initiatives and to reverse the trend of their insufficient inclusion, especially in the dry land areas, ALIN promotes the integration of women in development and information support.

41 African Medical Research Foundation see http://www.amref.org/info-center/amref-courses--training-programmes/elearning-programme-/  
42 http://www.alin.net/?maarifa_centers

4.2 ICTs and e-financing – new possibilities and dimensions

The financial intermediary sector that services small businesses is extending its reach to poorer sections of the economic community and to those clients who might not otherwise have access to financial services. ICTs are already being applied to serve small businesses in many ways, such as:

- Adapting and simplifying book-keeping, accounting and loan-tracking software;
• Computerizing financial reporting and performance measures, making them cost-effective, secure and accessible to both borrowers and lenders;
• Providing individual borrowers with secure, user-friendly account access through location points in local banks, post offices, and other community centers;
• Building up savings and credit schemes through mobile banking, smart cards, handhelds, and modified ATMs, in order to bypass the traditional methods of providing bank services. As banking services become a built-in function of mobile wireless telephony, these aspects of recording and completing transactions will expand.

Content example: SWAT Youth Front, Pakistan (hyperlink)

Established in 1997, Swat Youth Front (SYF)\textsuperscript{43} is a youth-oriented, not-for-profit and non-governmental organisation (NGO) using communication, advocacy, training, and service delivery to foster poverty reduction, gender equity, literacy, youth employment, women's empowerment, and disaster management in the Malakand range, North Western Frontier Province (NWFP), Pakistan. SYF works in partnership with community-based, public, and civil society organisations in an effort to:

• Promote socioeconomic empowerment among the marginalized,
• Promote gender awareness and sensitivity,
• Narrow gender gaps in education and economic participation, and
• Promote volunteerism and facilitate employment among youth.

Interpersonal approaches are central to SYF’s efforts to develop the skills of, and provide opportunities for, children, youth, and women, in particular. For example, in partnership with the Pakistan Literacy Commission, SYF trained 63 women in teaching methodologies and then implemented 63 non-formal schools in various parts of District Swat.

SYF also focuses on adult literacy; its Functional Literacy Programme was launched in March 1999 and is designed for working adolescent and adult women in various sectors of the Mingora region. In addition, in February 2000, SYF’s Women’s Skill Development Project (WSDP) was launched with the purpose of enhancing women’s skills and creating income opportunities at the local level. Vocational classes have been held and women’s saving committees formed. In an effort to protect the environment by encouraging use and reuse of household waste material, SYF has conducted various trainings for women to learn how to produce finished products while gaining an income.
To foster women's financial empowerment, SYF has also organized exposure/study tours for students and female entrepreneurs to historical places and the country's industrial cluster. The main purpose of these activities is to identify new channels and markets for Swati products. SYF has gone beyond such local initiatives by facilitating the participation of several female entrepreneurs in national and international exhibitions in order to get exposure and gain knowledge about how to market their products. The organisation has also developed linkages between these entrepreneurs and raw material suppliers. SYF has developed various advocacy campaigns, such as in the areas of women's and children's rights and socioeconomic issues.

Where women workers are unable to visit their bank after work to deposit their pay, mobile banking allows women either to make loan payments or add to their savings. Likewise, women may not have access to information about government benefits to which they are entitled. Where governments make such information available on the Internet, the same ICT devices that enable women to manage their credit and savings can also be used to access their benefits.

**Content example: Micro-finance loan software**

The **Loan Performer software** grew from humble beginnings in Uganda and is now employed in micro-finance institutions in 50 countries. Various software packages are contributing to the increase in efficiency of many Micro-Finance Institutions (MFIs). HISAAB, for example, is group-level microfinance software designed for illiterate and uneducated users. Currently the software is used by:

- Sero Business Women, Tanzania
- Mara Women Empowerment Assistance, Tanzania
- Women’s Finance House, Botswana
- National Association of Business Women, Malawi
- Tanzania Women Entrepreneurship (WEDTF), Tanzania
- Pamoja Women, Kenya

Micro-finance loan software

CONNECT A SCHOOL, CONNECT A COMMUNITY
cnectaschool.org


4.3 E-commerce, markets and small enterprise development

ICTs are being adapted and used to build women’s economic capacities. Women are being trained to use the Internet to buy and sell local products, to access current information on raw material prices, to use microfinance services, and to use software for financial and business management.

Trade and development in the context of globalization is as much female-led as it is export-led. Increasingly, policy-makers and business leaders alike are acknowledging the profit value of women’s involvement in small business. Business leaders cannot afford to ignore this critical section of the productive labour force. Many large corporations are increasingly producing, sourcing or distributing from developing nations, and this often involves working with local partners and small and medium enterprises (SMEs) as part of their value chains.44

One example of an international network that both advocates and supports credit programmes for women is Women’s World Banking (WWB). WWB is a global, not-for-profit institution dedicated to securing poor women’s access to finance, information and markets. The network incorporates retail institutions that provide over USD 5 billion in financial services to more than 10 million low-income women entrepreneurs—in Africa, Asia, Latin America, Europe and North America. Members of the network include micro-finance institutions, banks and associations that serve as models for others by:

- Embodying shared principles;
- Providing financial services that meet performance standards;
- Sharing best practices and experiences; and
- Using results on the ground to influence policy changes in their countries and around the world.

Women-led organizations and affiliates operate at the core of the network. Members of the network push each other, using mutual accountability to achieve results.
Content example: Tortas Peru – women cake sellers

Initiated in 1996, Tortas Peru is a woman-owned enterprise that uses ICTs to reach and serve a wider market, employing the Internet to take orders for their cakes. Tortas Peru markets heavily to the more than 2 million Peruvians who live outside the country, relying on its website to reach them. Clients in San Francisco or New Zealand can send a home-made cake to friends or family in several major cities. The tortas (cakes) are prepared and delivered by one of the housewives in the network. Customers can order a cake from a catalogue and pay using a credit card, check, money order or electronic payment. To maintain low prices, the company is based mainly on the Internet, making it necessary for the housewife-members to be familiar with computers and Internet.

Content example: Shea Butter Sales in Burkina Faso

When the women of the Songtaaba Association, an organization that markets shea butter skin care products in Burkino Faso, started using ICTs, their profits more than doubled. The use of cell phones and computers helped them to run their businesses more efficiently. The Association currently provides jobs to more than 3,000 women in 11 villages. To provide the women with regular access to ICTs and improve marketing and sales of their products, the association set up telecenters in two villages. These facilities are entirely managed by the rural women, who are trained by Songtaaba. The organization also set up a website, which the women manage. This has been particularly successful in boosting the visibility of the producers. Since the site went online two years ago, orders have gone up by almost 70 per cent. (also see similar story in Mali)

44 The World Business Council on Sustainable Development www.wbcsd.org offers several examples of large corporations partnering with small enterprises – including Pentland and Nike in Vietnam, SC Johnson and pyrethrum growing in Kenya, and Delta Corporation (food & leisure) outsourcing to SMEs in Zimbabwe.
4.4 Empowerment through networking

ICTs have also become effective tools for networking among women and women’s groups, allowing them to pool resources, information and numbers together to form cooperatives -- or simply to voice their desire for change. The importance of networking cannot be underestimated, as women often look to the broader women’s movement beyond their national boundaries for solidarity and policy shifts.

Content example: ALEAP networks bring women together for change

In Andhra Pradesh, India, small factories employ nearly a third of the people (22 million) of that state. Over a million women ran their own factories throughout the city, and while each was doing fairly well, they felt that by banding together, the daily challenges of business would be easier to manage. Many of them were in the same industry -- food processing, including tomato, spices, fruits, wheat, and cocoa powder.

In 1993, the women formed the Association of Lady Entrepreneurs of Andra Pradesh (ALEAP) to cater to the needs of women small-business entrepreneurs. They pooled their resources and approached the state government for 30 acres of land. They were helped by the fact that the government did have a policy to develop small industries, with women-owned enterprises singled out for special attention. ALEAP was able to obtain a government grant of USD 55,000 that was used to build common infrastructure such as roads, water, drainage and a power substation. The group has been able to create an innovative business-operating environment for themselves. Now, ALEAP is a one-stop center for women’s entrepreneurship, providing motivation, counseling, information on projects, advice on statutory and regulatory requirements, training, management of finance and market tie-ups, and infrastructure and project implementation.

In 2005, ALEAP announced the launch of its new initiative, “EU-India Network of Women Entrepreneurs,” a project funded by the European Commission under the EU-India Small Projects Facility and the Federal Ministry for Economic Cooperation and Development. Other partners include InWEnt-Internationale Weiterbildung und Entwicklung gGmbH and Capacity Building International, in Cologne, Germany. The project will provide training to entrepreneurs in the food-processing and garments sectors, enabling the production of globally competitive products in an environmentally
sustainable manner. The project facilitates networking with organizations in the European Union, in order to enable producers to access global markets.

The project deals with two important sectors: food processing and garments. With the abolition of quotas in the garments sector from 1 January 2005, additional effort was required to maintain existing market shares and access newer ones. In the food-processing sector, increasing India’s small share in the global market has the potential for increasing rural employment and providing a fillip to economic growth.

4.5 Links to reference materials

A Manual in two parts for practitioners - Gender-oriented Entrepreneurship Promotion (Swiss Agency for Development and Cooperation)

ILO’s Women’s Entrepreneurship Development and (WED) Capacity Building Guide

IFC’s Women in Business Program and WIN case examples (International Finance Corporation and Women In Business)

DFID/IDPM’s Women’s ICT Based Enterprise for Development practical guidance handbooks (Department for International Development and University of Manchester’s Institute of Development Policy and Management)

World Bank ICTs for Women’s Socio-economic empowerment

http://www.womenictenterprise.org/manworkshop.htm for a number of case studies presented at a 2006 workshop on Women’s ICT-based enterprise for development

Journal of Community Informatics http://ci-journal.net on Gender in Community Informatics (July 2010)
5 Guidelines for Ministries, Regulators and Private Sector

This section provides a series of checklists that are aimed at ensuring that both men and women have equitable chances to use and benefit from ICTs and to participate in community ICT centers. The section offers a summary list that project planners can use to consider opportunities that may have been overlooked. The first part of this checklist contains questions related to the inclusion of gender issues in the project cycle of setting up a community ICT center. The second part outlines indicative gender issues found in ICT projects and components. The third part provides links to a selection of online tools and guidelines.

5.1 Gender analysis and assessment in the Center’s development

Needs identification and design

• What are the special needs of men and women for ICTs related to the project? Have both men’s and women’s needs been considered in defining project objectives? Have both men and women participated in setting these objectives and expectations?

• What is the gendered division of labour in the target population of the project? Are there ways in which the ICTs employed in the project would increase men’s and women’s productivity and learning, or their access to, and control of, resources?

• What are the constraints that might block men or women from equitable participation in the center? Are there barriers and constraints that might affect men’s or women’s access to opportunities, resources, and decision-making?

• Has the impact of the project on gender divisions in the target population been considered? Are there any ways in which it might adversely affect women’s situations? If any negative impacts are foreseen, can the project be adjusted to overcome them?

Project preparation

• Have women representatives, gender-aware organizations and community members been consulted in the project planning process?
• Are the project design team and implementation staff, especially those concerned with ICT delivery, gender aware? If not, might they benefit from gender-awareness training?
• Have efforts been made to recruit gender-balanced staff and consultants?
• Is there a gender expert on the project team?

Project implementation

• Does the project include measures to equalize opportunities and access for both men and women?
• If it is likely that women would be under-represented in project activities, are there specific actions that target women?
• Are the institutions that will deliver services under the project gender-aware?
• Do men and women have equitable access to project ICT resources, including credit, training and facilities?
• Can partnerships be built to enhance outreach and improve access to ensure gender equality?
• Are regular consultations held with all key stakeholders?

Project monitoring and evaluation

• What measures are in place to capture user feedback from men and women?
• Will project-monitoring data be disaggregated by gender?
• Have indicators been identified that can be measured with gender-disaggregated data?
• Is gender analysis included in the terms of reference of the evaluation team?
• Is the evaluation team gender-balanced?
• Will gender-disaggregated data and indicators be collected and analyzed?

Measuring Outcomes

• Are any gender-positive outcomes anticipated? Among the possible gender-positive outcomes that might result from ICT projects are the following:
  • Improving opportunities for men and women to access, use and benefit from ICTs
  • Fostering shared control over decision-making and resources related to ICTs
  • Improvement in women’s income from the use of ICTs in the project
  • More women using ICTs (more) as a result of the project
  • Increased access to relevant information for women and men.
5.2 Guidelines for regulators

Sector liberalization

- Is sector liberalization being promoted in order to bring in investment and reduce end-user prices, thus making telecommunications and ICT more accessible to men and women?
- Is consideration given to reducing high customs duties on mobile telephones and computer equipment that deter women users, who are likely to have less disposable income than men?
- Is the national regulator directing private sector players to deliver on social and gender policy objectives such as universal access?
- In return for granting licenses, is the regulator compelling service providers to provide service to underserved areas where women predominate?
- Is the regulator providing funds for research, development and testing of technology that will serve women?
- Are gender-equity concerns a part of community service obligations performed by cellular phone operators?

Regulatory frameworks

- Do regulators permit the resale of mobile phone services, which may be profitable businesses for women to establish?
- Has the regulatory framework addressed reducing licensing fees, spectrum prices, and interconnection charges that might make ICTs more accessible to women?

Licensing

- Has consideration been given to reducing fees for telecommunications, Internet service provider (ISP), and mobile service licenses to promote improved affordability by women and the poor?
- Has consideration been given to allocating special licenses for rural operators or community ICT center operators -- especially those run by and for women?
• Do license awards contain conditions that promote gender analysis and mainstreaming within the licensed company?

*Universal access*

• Do universal access policies stress public access points as an alternative to more capital-intensive choices (one line per home) and ensure that locations of public access points are gender-sensitive (e.g. not just in bars or auto shops but also in schools, clinics and markets)?
• Whenever access to ICT is considered, do women have access? If not, what actions can be taken so that they will have access?

*Universal service obligations*

• If regulators call for establishment of telecenters in under-served areas, as part of license-holder universal service obligations, have the different needs of men and women in the concerned communities been considered?
• Does proposed service delivery to under-served areas reflect geographical gender distribution in the population?
• Are disadvantaged and/or rural women, such as single mothers, widows, or disabled women, given any priority for service, subsidies or special pricing??

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**Factors leading to mobile phones being too expensive for women**

In addition to the high cost of purchasing handsets, poor users can waste precious money trying to get connected in areas where they face poor signal coverage. They risk being charged even when they do not succeed in getting connected. In addition, when top-up cards have a short lifespan, (for example, only 15 days) users often must spend additional money when that time period runs out. Likewise, when a woman has to spend her only remaining money to make a call to distant relatives to request a remittance -- but cannot get her message through because of poor coverage -- she may nevertheless be forced to pay for the call. The pricing regimes of some service providers do not take into account the fact that some calls do not get to their destinations.

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45Rural women’s use of cell phones to meet their communication needs: a study from northern Nigeria, Kazanka Comfort and John Dada in Buskins and Webb 2009 (ibid)
5.3 Checklist for content providers and trainers

Courses and training in ICT skills

- Are there women facilitators or trainers?
- Are training materials accessible to illiterate populations and local dialect speakers?
- Where illiterate populations seek to develop ICT skills, is their illiteracy also addressed, e.g. through online training?
- Is any additional support or provision for women necessary? e.g. child-care?
- Are training activities and access times and locations compatible with women's daily schedules and possible travel limitations?

ICT and education projects

- Have efforts been made to ensure equitable access to ICTs for women and girls in schools and other educational facilities?
- Are girls' and women's responsibilities for domestic chores taken into account in scheduling access and training?
- Are there cultural or social issues that call for single-sex instruction in ICTs?

Systems for learning and training

- Do women have equal access to technical training?
- Have efforts been made to ensure that women are among those trained when introducing computer hardware and information systems?
- Are necessary adjustments made to facilitate women’s and girls’ participation in view of multiple roles and cultural constraints?
- Are there mechanisms for women to enter these fields and training programs or to develop as role models for young girls?
- Are training opportunities available not only for technology professionals but for non-professionals to use ICTs?
- Have attempts been made to find and select women participants?

Distance learning projects
• Is data on students/users disaggregated by sex (to show possible gender differentials in users)?
• Are the information and learning needs of both men and women considered in designing programs?
• Is the content of programs relevant to both men and women?
• Are there constraints to women participating in the courses (e.g. are courses for civil servants delivered at times that are convenient to women workers)?
• Does the distance learning incorporate flexibility in scheduling and location to accommodate both men and women?
• Are there differences in subjects and technical skill levels by gender, requiring remediation or accommodation?
• Are there differences in foreign language abilities by gender among the targeted recipients? For example, if courses are in English, are women less likely to have a mastery of that language?
• Does the course content recognize gender issues in the substantive material for the course (e.g. in public administration)?

**ICT content development projects**

• Is the information/content distributed in ways that make it easily accessible to women and men at varying levels of literacy, education and economic status?
• Is information made readily available to all users, regardless of class, race or gender?
• Are opportunities provided for women to discuss the information received and ways to deal with the socioeconomic barriers they face?
• What measures have been taken to protect women’s traditional knowledge, particularly about crops and plants, so that it can be preserved, used without exploitation, and patented, if appropriate?

**Information systems development (including health, legal and financial)**

• Do women have equitable access to the information in the system?
• Is the information relevant to their information needs?
• Is there equitable access for men and women to the training needed to use the system?
• Have attempts been made, where relevant, to incorporate women’s indigenous knowledge?
The *UNESCAP Guidebook*, based on the Malaysian experience, provides a set of success factors that can guide community ICT center development. It is described in the box below.

**Fact of Interest: Success factors for community e-centers (CeCs) in Malaysia**

- Focus on people, organization, content, and processes rather than on the technologies;
- Research the actual needs and socio-economic goals of the community;
- Provide ICTs and services via the CeCs, which are relevant to community needs;
- Find local champions who can motivate and mobilize the community;
- Capitalize on local strengths and resources in the development (planning, implementation, operation, evaluation and monitoring) of the CeCs;
- Sound business plans and sustainability models ensure the CeCs’ continuing existence and growth;
- Maintain ongoing monitoring and evaluation of the CeCs’ performance;
- Foster and develop smart partnerships (government, industry, NGOs, and community) for strategizing and translating CeCs’ goals into action; and
- Continue to train and educate the CeCs’ personnel and community.

Source: *Guidebook on Developing Community E-Centers in Rural Areas: Based on the Malaysian experience*, UNESCAP, 2006

### 5.4 Links to reference materials, online toolkits and guides

Connecting the first mile: investigating best practice for ICTs and information sharing for development

Guidebook on Developing Community eCenters in Rural Areas (Based on Malaysian experience, UNESCAP, NY 2006) [http://www.ictregulationtoolkit.org/en/Publication.3372.html](http://www.ictregulationtoolkit.org/en/Publication.3372.html)

Telecottage handbook: How to establish and run a successful telecenter (June 2006, UNDP Europe and the CIS) [http://www.is-watch.net/node/758](http://www.is-watch.net/node/758)


Surmaya Talyarkhan, David J. Grimshaw, Lucky Lowe (Intermediate Technology Development Group – ITDG)

A practical guide to establishing a telecottage, as well as a valuable source of experiences and lessons learned, this report was prepared by members of the telecottage movement. The Hungarian experience is used as a reference point throughout the report. This publication is intended for ICT professionals, community development practitioners and public administrators who wish to improve social services delivery at a local level, and who recognize that telecottages can be used in service of individual, local and community poverty reduction.

6 International, regional and gender-specific policy frameworks

In calling for "participation and active involvement of girls and women in the decision-making process of building the Information Society" the World Summit for the Information Society (WSIS) recognized the importance of greater female inclusion. There is a strong link between women, ICTs and the Millennium Development Goals (MDGs). ICTs can, for example, facilitate achievement of MDG 3, to promote gender equality and empower women.

There are several examples of ICTs becoming important tools for women’s empowerment, with women as the primary drivers in using ICTs for development purposes. Despite important gender issues that may arise for women as users and employees -- including the many women who work in call centers,
and as entrepreneurs -- research on ICT gender issues continues to be minimal. This needs renewed attention. Working to increase women’s access to ICTs is central to the achievement of a number of international treaties and targets. While this list is not exhaustive, it touches on some of the most important frameworks.

6.1 International policy frameworks

This section describes the most salient international agreements and conventions that address gender-equity and bear on ICT regulations, policies and services.

The Convention on the Elimination of all forms of Discrimination against Women (CEDAW)

CEDAW defines discrimination against women as: “any distinction, exclusion or restriction made on the basis of sex which has the effect or purpose of impairing or nullifying the recognition, enjoyment or exercise by women...of human rights and fundamental freedoms in the political, economic, social, cultural, and civil or any other field.” ICTs are an essential element in enabling women to access their human rights and entitlements in those spheres, and so ICTs are essential to the practical implementation of CEDAW.

http://www.un.org/womenwatch/daw/cedaw

The Millennium Development Goals

The Millennium Development Goals (MDGs) are an agreed set of key objectives to address the world’s main development challenges; they were adopted by the United Nations General Assembly in 2000. There are eight MDGs, broken down into 21 quantifiable targets, which are measurable by 60 indicators. The UN recommends that all indicators should be disaggregated by gender. But in fact, ITU as well as the other UN agencies in charge of MDG indicators face great difficulty in collecting reliable gender-disaggregated data, especially in developing countries. Besides gender mainstreaming for all MDGs, the MDG 3 is specific to women’s empowerment:

MDG 3: Promote gender equality and empower women
ICTs provide an excellent means of opening up opportunities in education, employment, and access to information, and they have the potential to neutralize much of the discrimination traditionally faced by women. The flexibility provided by the use of ICTs in education or work enables women to balance familial and social responsibilities, and it can help overcome issues of mobility. In essence, ICTs increase women’s ability to act autonomously, and enable them to better access their rights. In particular, ICTs can help achieve MDG target 3a: “To eliminate gender disparity in primary and secondary education...and in all levels of education no later than 2015.” They also can play a significant role in working toward the three indicators under MDG 3, namely:

3.1: Ratios of girls to boys in primary, secondary and tertiary education
3.2: Share of women in wage employment in the non-agricultural sector
3.3: Proportion of seats held by women in national parliament

ICTs are directly relevant to these goals in both cause and effect. That is, increasing women’s access to ICTs will help achieve these goals, and achieving the goals will also help increase women's access to ICTs. ITU is the line UN agency in charge of ICT related indicators.

**MDG 8: Develop a Global Partnership for Development**

ICTs are directly relevant to target 8f: “In cooperation with the private sector, make available the benefits of new technologies, especially information and communications.” ICTs will help achieve three specific indicators under MDG 8, namely:

8.14: Increasing the number of fixed telephone lines,
8.15: Increasing the number of mobile cellular subscribers, and
8.16: Increasing the number of Internet users.

The target date for achieving the MDGs is 2015. Improving women’s access to ICTs cuts across seven MDGs targeted at specific objectives, and appears as a goal itself within the eighth goal.

http://www.un.org/millenniumgoals/

**World Summit on the Information Society Targets**
The World Summit on the Information Society (WSIS) is an initiative of the International Telecommunications Union (ITU). Its objective is to "build the framework of an all-inclusive and equitable Information Society," and to find ways to use ICT to advance development goals, such as those contained in the Millennium Declaration.

http://www.itu.int/wsis/index.html

**Poverty Reduction Strategy Papers**

Poverty Reduction Strategy Papers (PRSP) are blueprints for reducing poverty in developing countries, drawn up by the national governments in collaboration with civil society and with input from the World Bank and the International Monetary Fund. They place a great emphasis on social indicators and on building the capacity of state actors to regulate the economy. In the 29 PRSPs analyzed in 2003, 12 countries (Albania, Azerbaijan, Cambodia, Cameroon, Chad, Gambia, Ghana, Mali, Mozambique, Niger, Rwanda and Sri Lanka) define or categorize ICTs as a strategic component for poverty reduction, and discuss it as an independent item in their PRSPs.


6.2 Regional policy frameworks

ICT infrastructure tends to be regional, due to boundaries in wireless and fiber optic technologies, which is why ICT policy frameworks often reflect the same regional borders.

*Caribbean Community (CARICOM) Secretariat*

The CARICOM ICT strategy is an instrument for strengthened connectivity and development to foster greater prosperity and social transformation between and among member states, as well as the rest of the world. In CARICOM, there is a continuing focus on mainstreaming ICT activities and development to effectively contribute to the achievement of the Millennium Development Goals, particularly those related to poverty reduction, education, and health, environment and gender equity.

http://www.caricom.org/jsp/projects/projects_ict.jsp?menu=projects

*Association of South East Asian Nations*
The Association of South East Asian Nations (ASEAN) is governed by the 2000 e-ASEAN Framework and by the annual meeting of the telecommunications ministers, known as TELMIN. ASEAN has made a number of declarations and plans of action with respect to ICTs. Related to telecenters for women is the Siem Reap Declaration on Enhancing Universal Access of ICT Services in ASEAN (2007), which commits to enhancing access to ICT services so that the rural communities and remote areas in the ASEAN region will have equal access and connectivity at affordable rates.

http://www.aseansec.org/6267.htm

**New Partnership for African Development**

The New Partnership for African Development (NEPAD) e-Africa Commission is the ICT arm of NEPAD. It works for long-term solutions for the development of the ICT sector in Africa. The NEPAD e-Africa Commission creates partnerships and collaborates with governments, companies and local people to realize positive change in the ICT sector. http://www.eafricacommission.org/

**African Union**

The African Regional Action Plan on the Knowledge Economy seeks to build a region fully benefiting from ICT services by the year 2015. It commits the African Union and countries of the region to adopt gender-sensitive approaches to enable women to better access ICTs.


http://www.uneca.org/aisi/docs/ARAPKE%20version%20of%20September%202005.pdf

**Organization of American States and the Santo Domingo Declaration**

The Santo Domingo Declaration is a commitment from the 34 foreign affairs ministries of the Organization of American States to take all measures needed to develop ICT in their countries. The declaration recognises the importance of the gender perspective and the need to enhance women's equitable access to the benefits of ICTs. It also aims to ensure that ICTs become a central tool for the empowerment of women and promotion of gender equality. Policies, programs, and projects need to address gender inequalities in access to and the use of ICTs.
7 Final comments

In essence, ICTs are no longer an optional extra to other services. The use of the Internet, mobile phones and social networking sites are becoming as commonplace as television, newspapers and radio. Consequently, not having access to these technologies is a form of illiteracy itself. Virtually all international agencies and governments recognize this. Millennium Development Goal 8 contains specific targets with respect to ICTs, and the next round of targets developed after 2015 will undoubtedly place even greater emphasis on the centrality of communications technologies and computing to international development.

At the same time, increasing numbers of governments and international organizations are also recognizing the importance of empowering women and girls. Women’s empowerment is, and should continue to be, pursued primarily as a rights-based objective. Women and girls make up half of humanity and all political and economic strategies must give explicit recognition to this fact. There is also increasing recognition of the overall importance of women’s empowerment to social and economic development.

Programmes aiming to use ICTs as tools to empower women are therefore directly related to two of the foremost development challenges of the early twenty-first century: expanding ICT access and empowering women. Both objectives also relate to a host of other developmental goals. Empirical research from all corners of the globe proves that empowering women helps reduce poverty, child morbidity and mortality, and increases children’s enrolment in schools. As the United Nations Secretary General, Ban Ki Moon, puts it: “Investing in women is not just the right thing to do. It is the smart thing to do.”

As shown by the selection of case studies in this module, establishing community ICT centers can be an important way to introduce and expand women’s access to ICTs. However, simply establishing the center and assuming that women will come and use it is not enough. As with any development project, the beneficiaries themselves (in this case local women) must be involved from the inception phase
onwards. Moreover, the center must be made relevant to the day-to-day needs of the women it is serving. The center must be maintained from a technological point of view, and it must be compliant with the socio-cultural norms of the society in which it is operating.

Amartya Sen⁴⁹ argues for the centrality of women in the knowledge society. “Knowledge is not only for economic growth, but its foremost use should be to empower and develop all sectors of society to understand and use knowledge to increase the quality of people’s lives and to promote social development. A socially inclusive knowledge society empowers all members of society to create, receive, share and use information and knowledge for their economic, social, cultural and political development.” It is, therefore, an imperative from the perspective of women and ICTs that emphasis and focus be placed on gender relations in communications and learning. Once we do that, we may see that the information society is not an end in itself but rather the innovation of ordinary people.


Credits

The Module on Community ICT Centres for the Social and Economic Empowerment of Women was drafted by Ms. Nidhi Tandon, Director, Gender Consultant & Trainer, Networked Intelligence for Development (NID), Toronto, Canada, an independent development consultancy that provides policy advice and adult-training and know-how on a wide range of human, social and economic development concerns offering a first-hand understanding of grassroots, small business and government-level policy planning. NID can be found at www.networkedintelligence.com

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Annex I: Technology Facts and Figures

**Technology Facts & Figures**

TABLE I: Individuals who used the Internet (from any location) in the last 12 months, by gender (%), 2009 or latest year available.

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Notes: Age scope varies among countries.
(1) In the last 3 months. (3) Sample results. (5) In the last month. (7) In the last 6 months.

Source: International Telecommunication Union World Telecommunication/ICT Indicators database

TABLE II: Ownership and usage of mobile phones by age, women in low and middle income countries

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<thead>
<tr>
<th>Age</th>
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<td>14-20</td>
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In a 2010 Cherie Blair Foundation survey, girls and young women between 14 and 27 had the highest rates of mobile phone ownership among women.


51Women & Mobile: A Global Opportunity A study on the mobile phone gender gap in low and middle-income countries, Cherie Blair Foundation 2010

**Annex II: Case Studies: Community ICT centers and ICT applications that cater to women’s needs**

List of Case Studies

I. Advancing Learning and Employability for a Better Future (ALEF) in Morocco
II. CISCO Systems Networking Academy
III. Datamation Gender Resource Center, India
IV. Guanabanet – The Taiguey Foundation in the Dominican Republic
V. IKRAA - Computer Based Software for Illiteracy Eradication in Lebanon and Egypt
VI. Rural Knowledge Centers in India
VII. School-Net Uganda - Inspiring Science for Girls Using ICTs in Uganda
VIII. Thai Telecenter Movement
IX. The Women’s Technology Empowerment Center (W.TEC) – Nigeria
X. Modemmujer - ICT literacy and women’s citizen participation in Mexico
Module: Etiam pulvinar urna

Lorem ipsum


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2. Vivamus luctus, ante eget iaculis viverra, massa ipsum auctor tellus, in mattis nisi nisi nec odio.
3. Duis quis scelerisque dolor. Mauris tincidunt mauris non nunc porta volutpat.
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5. Donec lacinia accumsan nibh, ut commodo massa posuere in.
6. Phasellus a tellus turpis.

Vivamus diam nulla

Updated Module 1: Policies and Regulation to Promote School Connectivity

Introduction

Information and Communication Technology (ICT) increasingly makes education more accessible and more universally and equitably available to all. ICT also enables more efficient delivery of quality teaching, more effective learning, and better educational management, governance and administration.

Many countries are realizing the importance of connecting their educational institutions to the Internet and, as a result, have developed e-learning and m-learning strategies for connecting schools and students. Countries also realize, however, that in defining their National School Connectivity Plans, it is also important to identify how well their plans dovetail with teachers’ ability to implement them. Do teachers have the experience and knowledge to incorporate ICT into lesson plans, teaching methodologies and curricula? Are there funds devoted to procuring ICT-related connectivity and other resources?

Connectivity provides many benefits including access to an ever-growing volume of educational information, opportunities for collaboration and the use of online 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 Internet 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 the Internet can benefit groups with special needs.
Although many of the benefits identified are only achievable through broadband connectivity, that connectivity can be achieved through a myriad of technologies. All forms of connectivity, including fixed and mobile broadband, as well as satellite broadband, must be considered. In addition, there are multiple types of devices and media for delivery of ICT. Given the importance of ICT to the educational process, multiple delivery modes should be considered, including, for example, “m-education” initiatives or simulated access to a selection of Internet resources through e-reader devices or other such devices.

This module mainly examines primary and secondary school connectivity, since this is the emphasis of most ICT infrastructure-for-education initiatives. Total Cost of Ownership is also considered, however, particularly since many small and remote, rural schools lack access to electricity grids, affecting their connectivity costs and hindering their participation in Internet connectivity initiatives.

Section 1 elaborates on the benefits of school connectivity. Section 2 identifies international and regional goals and targets with 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 in detail the next step of incorporating connectivity 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 The 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 Internet and, especially, broadband connectivity. In particular, policymakers and educators now understand that Internet connectivity for schools can have a wide array of short-term, medium-term and long-term benefits and that many of those benefits identified are only achievable through broadband connectivity.
However, it is also clear that the use of technology in education (computers and connectivity) will have a more positive impact if connectivity and the resulting opportunities and benefits are also incorporated into teaching and learning methods. An Inter-American Development Bank (IDB)-financed programme in Uruguay, for example, is maximizing the impact of that country’s Ceibal initiative to provide computers to all students in the country by training teachers and other staff. Uruguay is strengthening the educational components of the plan, improving monitoring activities to better gauge impacts, and extending the use of computers to the broader society, particularly in low-income areas.\footnote{IADB, Computer use in schools strengthened and extended beyond the classroom in Uruguay, available at: http://www.iadb.org/en/mapamericas/uruguay/computer-use-in-schools-strengthened-and-extended-beyond-the-classroom,5839.html}

Access to new and better resources, combined with the development of new educational methodologies and pedagogies, will lead to important results in the short, medium and long term.

1.1 Short-term impact

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; (2) Improved access to existing resources; and (3) Immediate and permanent flow of communication between schools, between teachers and students (as well as their families) and between schools and educational system authorities.

1.1.1 Access to content and tools

In the short term, extending Internet and, in particular, 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 Internet -- and especially broadband -- connections enable a greater expansion of the types of content available, allowing higher levels of interactivity in educational settings.

Internet 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, Internet-enabled educational tools, including mobile phones, are not generally seen as a "disruptive" force but more often as a positive one in educational programmes around the world, enabling the creation of more effective and engaging educational models.

### 1.1.2 Improved access to existing resources

Studies have shown that the introduction of ICTs in the educational process has great potential for knowledge dissemination, effective learning and the development of more efficient educational services. Similarly, improved ICT infrastructure and technology applications can increase and improve access to ICT resources and services. Within this context, however, experience also shows that there are certain formats that make multiple educational resources more readily accessible, as well as more relevant, to most teachers and learners in least developed countries (LDCs). Personal Digital Assistants (PDAs), laptops, Pocket PCs, and mobile phones -- even material stored on CDs or USBs -- can provide interactive content to previously unreachable and remote locations.

In Ethiopia, there is a programme supported by IICD (Institute for International Cooperation and Development) and Edukans in the Connect4Change consortium, and by Ethiopian partner Development Expertise Centre Ethiopia. This programme allows primary school teachers and teacher trainees at 75 schools throughout Ethiopia to record their classes on video. They can then evaluate and improve their teaching skills and make use of computers to plan their lessons more efficiently. According to teachers participating in the programme, the motivation of students has increased and results have improved. 2

Traditional, classroom-based approaches to learning can be supplemented by learner-centred, anytime-anywhere learning modes, potentially increasing participation and school retention rates. Delaying the introduction of ICT-enabled education resources is no longer an option. But the simple introduction of e-readers can be an initial starting point for the full integration of ICTs into schools.
The main point is that technology is essential. A recent McKinsey report, commissioned by the GSM Association, shows that in the United States, for example, the oral fluency of kindergartners in New Mexico tripled just three years after educators began using mobile computing devices to assess individual students’ progress and to tailor lessons to their needs. This is just one example of m-education’s tremendous potential.  

Experience also shows that when broadband service replaces a slower Internet connection, such as dial-up service, students and educators gain even better 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.

Internet 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 programmes around the world, Internet and mobile phone-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 impact

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 cognitive and non-cognitive skills, (2) timely access to new resources, and (3) generating interest in ICTs in the wider community.
1.2.1 Improved cognitive and non-cognitive skills of students

Changes to educational curricula spurred by the introduction of online content and research tools have the potential, over the medium term, to improve cognitive and noncognitive skills. \(^4\)

A May 2009 review carried out for the United States Department of Education\(^5\) 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.

Recent developments in m-education show a positive impact from the use of mobile phones in schools.

A recent GSM Association report illustrates this through a number of examples:

- In a school in New Mexico, teachers are using mobile computing devices to regularly assess kindergartners’ reading progress and then tailor instruction to help them develop oral fluency. Within the first three years of use, the share of students reading at benchmark levels rose from 29 per cent to 93 per cent.
- In India, primary schools used mobile-phone games to help students from rural, low-income households learn English. Aided by local teachers, researchers devised a simple game to develop listening comprehension, word recognition, sentence construction and spelling. Test scores of students using the mobile-phone games improved by nearly 60 per cent. \(^6\)

In 2012, the non-profit organization World Reader published the results of iREAD, its year-long, USAID-funded pilot programme in Ghana. iREAD involved the wireless distribution of more than 32,000 local and international digital books, using Kindle e-readers, to 350 students and teachers at six
pilot schools in Ghana’s Eastern Region between November 2010 and September 2011. The results indicated that primary school students with access to e-readers showed significant improvement in reading skills and in time spent reading, and that the programme was cost-effective over that period. 7

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. 8

4 Non-cognitive attributes are those academically and occupationally relevant skills and traits that are not specifically intellectual or analytical in nature, and include personality and motivational habits and attitudes that facilitate functioning well in school. Non-cognitive traits, skills and characteristics include perseverance, motivation, self-control and other aspects of conscientiousness. (See Borghans, L., Duckworth, A.L., Heckman, J.J. & Weel, B., The Economics and Psychology of Personality Traits NBER Working Paper No. 13810, Cambridge, MA, National Bureau of Economic Research, 2008.)


8 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, Internet 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. Internet connectivity can serve as an equalizer, making current, and even experimental, materials more readily available to educators in a timely fashion.

This is also the case where mobile technology is used in classrooms. Given that mobile networks cover almost 90 per cent of the global population today, m-education can enable teachers and students across the globe to access locally and globally relevant content.  

Moreover, Internet 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 Internet connectivity as an educational tool for children acts as a motivating force for parents to obtain Internet service at home.  

Increased demand then attracts interest from governments and other organizations that may want to fund broadband deployment, in particular. 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, Internet-connected schools can serve as ICT centres 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 centres that offer access, training, and support services.

1.3 Long-term impact

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 student achievement
- Improved access to social services, and
- Improved access to markets and to goods and services.

1.3.1 Improved student achievement

Recent literature suggests that the impact of ICTs on student achievement is a long-term effect, especially if this is considered in terms of standardized tests associated with the curriculum. Medium-term impacts can be expected in the development of cognitive and non-cognitive skills.\(^\text{11}\)

Over the long term, Internet 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, which 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.\(^\text{12}\)

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.\textsuperscript{13}

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 ICTs and education. Coordinating these plans and efforts can provide a key means to expand opportunities for socioeconomic development.


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

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 Nations, the World Bank, the European Union, and others. Some of their efforts have been embraced through (1) the Millennium Development Goals (MGDs), (2) the World Summit on the Information Society (WSIS), (3) the Broadband Commission, and (4) the World Education Forum.

2.1 International initiatives

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been embraced through (1) the Millennium Development Goals (MGDs), (2) the World Summit on the Information Society (WSIS), (3) the Broadband Commission, and (4) 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.\(^{14}\)

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.\(^{15}\) 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.\(^{16}\)

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 accessibility. 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.”\(^{17}\)


\(^{16}\) The Millennium Development Goals Report 2008, pg. 16.

### 2.1.2 World Summit on the Information Society (WSIS)

The International Telecommunication Union's (ITU's) Plenipotentiary Conference of 1998 recognized that ICTs are important for economic and social development. As a result, the World Summit on the Information Society (WSIS)\(^{18}\) was proposed 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.\(^{19}\)

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 Geneva Plan of Action (2003) defined, as an objective, the goal that everyone should have the necessary skills to benefit fully from the Information Society, and that within this context, capacity-building and ICT literacy are essential. The Plan of Action indicated that ICTs can contribute to achieving universal education worldwide, through the delivery of education, teacher training, improved conditions for lifelong learning (encompassing people who are outside the formal education process), and improved professional skills.

Within this context, the 2003 Plan of Action covered 16 areas relating to e-learning, 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.\(^{20}\) It also recommended removing gender barriers to ICT education and empowering ICT use in rural and underserved communities.\(^{21}\) 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."  

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

The second phase of WSIS, meanwhile, was held in Tunis in 2005, resulting in 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." This reinforced support for the provision of universal, equitable and affordable access to ICTs.

The Tunis Agenda for the Information Society, meanwhile, acknowledged 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.

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

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 children 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; and

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.  

The EFA goals are monitored on an annual basis by UNESCO.

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, emphasizing 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.27

The 2011 EFA Global Monitoring Report states that 67 million children were out of school worldwide in 2008. The report adds that to achieve EFA goals by 2015, 1.9 million qualified teachers are needed; more than half will be needed in the sub-Saharan Africa region alone.28


2.1.4 Broadband Commission for Digital Development

ITU and UNESCO set up the Broadband Commission for Digital Development in May 2010, in response to UN Secretary-General Ban Ki-Moon’s call to step up UN efforts to meet the Millennium Development Goals (MDGs). The Commission aims to boost the importance of broadband on the international public policy agenda and defines practical ways in which countries — at all stages of development — can expand broadband access, in cooperation with the private sector, to facilitate the achievement of the MDGs by 2015.

While not addressing the topic of ICTs in education directly, the Broadband Commission argues that progress towards achieving each of the MDGs can be accelerated with ICTs, in general, and broadband in particular. This is not because ICTs and broadband are not end-goals in themselves, but because they are cross-cutting drivers of socio-economic development like no other technologies in the modern world. ICTs can bring healthcare, education and government services to people wherever they live, as well as leveraging training opportunities around the world.  

At the Broadband Leadership Summit in Geneva in October 2011, the Broadband Commission established four targets for making broadband policy universal and for boosting affordability and broadband uptake, which in turn will also affect school connectivity. The targets are:

**Target 1:** Making broadband policy universal. By 2015, all countries should have a national broadband plan or strategy or include broadband in their Universal Access / Service Definitions.

**Target 2:** Making broadband affordable. By 2015, entry-level broadband services should be made affordable in developing countries through adequate regulation and market forces (amounting to less than 5% of average monthly income).

**Target 3:** Connecting homes to broadband. By 2015, 40% of households in developing countries should have Internet access.

**Target 4:** Getting people online. By 2015, Internet user penetration should reach 60% worldwide, 50% in developing countries and 15% in LDCs.
2.2 Regional initiatives

Around the world, several regional initiatives have been initiated to promote school connectivity. Some have evolved from international initiatives such as the World Summit on the Information Society (WSIS) and the Millennium Development Goals (MDGs).

Some initiatives to achieve school connectivity are international, but not necessarily global. These initiatives 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.

There is also the phenomenon of Regional and National Research and Education Networks, which seek to offer high-speed, high-quality Internet connections for research and education. These RRENs and NRENs are addressed in section 2.2.5

2.2.1 Latin American and Caribbean Countries (LAC)

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 containing 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.
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 those groups.32

The Rio Commitment led to the definition of eLAC 2007, the regional plan of action for the 2005-2007 period, which 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…"33

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 status of the spread of ICTs, according to the goals and activities established in eLAC 2007. It 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 eLAC2007.34

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, called for increasing efforts to achieve the region’s priorities in education.35 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.36

eLAC 2010, which followed the San Salvador Declaration, 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) the 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.37

The process continued with the adoption of the Lima Declaration and the definition of eLAC2015, which contains eight thematic areas, 10 lines of action, six priorities and 26 goals, including developing and implementing ICTs for inclusive education. Providing universal access to ICTs for education, and expanding their use in this field, is defined as a priority under this action item.38

The Plan particularly provides that:

The policy for maximizing use of digital technologies in the context of education must be viewed as a policy of State. This policy must include advanced training for teachers in technological, cognitive and pedagogical areas, the production of digital contents and interactive applications, innovative teaching and learning methodologies and the use of cutting-edge technological
resources, including the provision of broadband and other systems with the potential to transform teaching.³⁹

In terms of connectivity, Goal 23 of the Plan calls for efforts to:

Connect all educational establishments to broadband and increase their computer density, while promoting the use of convergent educational resources such as mobile phones, video games and open interactive digital television. In this connection, foster public policies that support collaborative teaching and research activities carried out over national and regional research and education networks. In particular, promote support for the CLARA network and CARIBnet in managing and obtaining passive infrastructure, thus strengthening the regional network for science, technology, research and innovation.⁴⁰

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

Source: ECLAC


³³ San Salvador Commitment, Second Ministerial Conference on the Information Society in Latin
America and the Caribbean, February 2008.


2.2.2 New Partnership for Africa's Development: The e-Africa Programme (NEPAD)

NEPAD’s e-Africa programme (formerly called the NEPAD e-Africa Commission) aims to promote Africa as a globally competitive digital society by developing policies, strategies and projects at the continental level for the development and use of information and communication technologies (ICTs) throughout Africa.41

A key project of the e-Africa programme is the NEPAD e-Schools Initiative, which was adopted in 2003, during the Africa Summit of the World Economic Forum. The Initiative is a priority regional activity to ensure that primary and secondary students in Africa have the skills 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. To date, sixteen African countries have signed MoUs with the NEPAD e-Africa Programme and a consortium of private sector companies to participate in the NEPAD e-Schools demo Project. More than 80 demonstration NEPAD e-School installations have been implemented. Each school in the demonstration project was equipped with a computer laboratory containing at least 20 PCs, as well as a server, networking infrastructure and peripheral devices such as scanners, electronic whiteboards and printers. The schools were connected to the Internet to enable them to access content and to communicate with the rest of the world.42


42 NEPAD e-Africa Programme. Available at: http://www.nepad.org/ regionalintegrationandinfrastucture/ infrastructure/ict

2.2.3 ECOWAS

Ministers of Education of the Economic Community of West African States (ECOWAS) in 2004 asked the ECOWAS Commission to establish an online/distance education programme for the region using ICTs.

In response, the President of the Commission in 2006 set up the ECOWAS e-Learning Task-force. That task force’s Policy Statement now guides the Commission’s pilot e-Learning Initiative, which is designed to revolutionize education in West Africa as part of the institution’s all-round integration programme.

The principal objective of the public/private ECOWAS e-Learning Initiative is to make education not only more accessible, but also affordable for youths and the larger society. This will create flourishing ICT enterprises, making the young people with ICT skills more employable, engaged and capable of realizing their full potential in their communities and countries.43

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 realize 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

\[ \text{Member States [to] ensure that all schools in the Union have access to the Internet and multimedia resources by the end of 2001.} \]

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 per cent (See Figure 2-2).

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

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 European Commission in February 2003.

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
the use of ICTs through an increased availability of high-quality infrastructure, as well as availability of attractive services and applications and the encouragement of organizational change.

The eEurope 2005 Action Plan, for example, focused on exploiting broadband technologies to deliver online services in both the public and private sectors.\textsuperscript{46} 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.\textsuperscript{47} Within that context, the European Commission promotes "eAccessibility," which is aimed at ensuring that people with disabilities and elderly people can access ICTs on an equal basis with others.

The year 2010 also saw the adoption of the \textit{Digital Agenda for Europe} and the \textit{Europe 2020 Strategy}. The 2020 Strategy identifies three key drivers for growth, to be implemented through concrete actions at EU and national levels: (1) smart growth (fostering knowledge, innovation, education and digital society), (2) sustainable growth (making production more resource-efficient while boosting competitiveness) and (3) inclusive growth (raising participation in the labour market, the acquisition of skills and the fight against poverty).\textsuperscript{48}

Smart growth is defined as improving the EU's performance in:

- Education (encouraging people to learn, study and update their skills);
- Research/innovation (creating new products/services that generate growth and jobs and help address social challenges); and
- Digital society (using information and communication technologies).\textsuperscript{49}

The \textit{Digital Agenda for Europe} specifically addresses the use of technology in education, urging, for example, that e-learning be addressed in national policies on modernizing education and training, including curricula, assessment of learning outcomes and professional development of teachers and trainers.\textsuperscript{50}

The EU sought to recognize that e-learning enables people to acquire skills anywhere, anytime. Meanwhile, ICTs empower teachers to adopt new practices, to tailor interventions on the basis of personal learning needs and to individualize assessment. ICTs also cater to individuals needing self-
regulated and informal learning, and they accommodate different learning styles and innovative, collaborative learning practices. ICTs also support more efficient workforce training on a global scale, improving delivery, reducing training costs and time-to-competencies.\textsuperscript{50}

\textsuperscript{44} \url{http://ec.europa.eu/information_society/eeurope/2002/documents/archiv_eEurope2002/actionplan_en.pdf}


\textsuperscript{47} European Union i2010 initiative, available at: \url{http://ec.europa.eu/information_society/eeurope/i2010/index_en.htm}

\textsuperscript{48} Europe 2020 initiative, available at: \url{http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/flagship-initiatives/index_en.htm}

\textsuperscript{49} \url{http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/priorities/smart-growth/index_en.htm}

\textsuperscript{50} Digital Agenda for Europe, Action 68: Member States to mainstream e-learning in national policies, available at: \url{http://ec.europa.eu/information_society/newsroom/cf/fichedae.cfm?action_id=226&lar_id=48?tion=Action%2068%3A%20Member%20States%20to%20mainstream%20eLearning

2.2.5 Regional Research and Education Networks

The role of \textit{National Research and Education Networks} (NRENs) in providing connectivity to schools cannot be underestimated. NRENs, which for the last decade have also been evolving, in many cases, into \textit{Regional Research and Education Networks} (RRENs), can help to address pricing inequities across countries by:
a) Aggregating demand among universities and, more broadly, within the school sector;

b) Architecting networks with points of presence across broad and complex geographies; and

c) Working across national boundaries to create regional optical networks.  

NRENs and RRENs originally were established more than 20 years ago in Europe and the Americas as dedicated networks for the research and education community to support bandwidth-intensive applications in research. In recent years, however, they have been established around the world, increasingly bringing Internet connectivity to schools.  

At present, about 100 countries in the world have adopted an NREN as the centrepiece of their information and communication technology (ICT) plans for tertiary education institutions and for interconnecting research institutes and other institutions, such as schools and hospitals. 


In many cases, schools are connected through the NREN, which may also be connected to various RRENs. GÉANT, for example, connects students in more than 20,000 primary and secondary schools across 40 countries, linking NRENs throughout Europe.
In Portugal, the process of providing Internet to schools has been managed by the Portuguese National Foundation for Science Computation, known as FCCN. As a private foundation under the tutelage of the Ministry of Science, Technology and Higher Education, the FCCN operates an NREN that connects all schools, institutions of higher education and research labs. The Portuguese NREN is, in turn, connected to the European Regional REN called the GEANT network.\(^{55}\)

In Namibia, the Xnet Development Alliance Trust, which joined the Ubuntunet Alliance in 2012, was established through a partnership between the incumbent fixed-line telecommunications provider (Telecom Namibia) and a local NGO (SchoolNet Namibia). As a connectivity provider for schools, Xnet’s sole beneficiary from 2004 to 2007 was SchoolNet Namibia. In 2007, Xnet expanded its operations to include all educational institutions. Through partnerships with telecommunications operators in the country, Xnet was able to secure subsidized pricing on behalf of its beneficiaries, which include tertiary institutions, libraries, teacher’s resource centres, vocational training centres, as well as schools. Beyond connectivity, the Xnet ISP offered services such as e-learning, email provisioning, website hosting, spam filtering, etc.\(^{56}\)

As stated by Louis Fox in a recent discussion in the Education Technology Debate:

> “NRENs can create leading-edge network capability for the international research community; they enable revolutionary Internet applications; they ensure the rapid transfer of new network services and applications to the broader Internet community; they provide a platform for sharing scientific (and other) applications and resources; they aggregate demand for bandwidth and thereby create “buying clubs,” drive down the cost of bandwidth; and they create social value by including communities outside their primary research university constituencies, like primary and secondary schools, libraries, museums, scientific and cultural institutions. In order to flourish, NRENs must focus on the technical dimensions of data networks and they must also attend to the human dimension, the creation of shareable expertise for support and collaboration across many fields of research and education.”\(^{57}\)

In the U.S., the K20 Initiative now engages schools in 43 of the 50 states, including more than 70,000 schools and millions of students. It was not conceived at the outset of the creation of Internet2 but has become one of the hallmarks of the U.S.’s advanced R&E network initiatives.\(^{58}\)

52. *Regional Strategy for C@ribNET: Provision of Blueprints for the Development and Implementation of National Research and Education Networks (NRENs), Blueprint for Barbados*. Available at: http://www.ckln.org/home/sites/default/files/Barbados_Blueprint__-_B_&_F[1]_0.pdf

53. *Regional Strategy for C@ribNET: Provision of Blueprints for the Development and Implementation of National Research and Education Networks (NRENs), Blueprint for Barbados*. Available at: http://www.ckln.org/home/sites/default/files/Barbados_Blueprint__-_B_&_F%5b1%5d_0.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. The paragraphs below give some examples of national initiatives. Chapter 6 contains a number of detailed case studies of such plans and strategies.

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 aimed to double the number of broadband connections, covering the entire country during the 2007-2012 period.\(^{59}\) Ericsson is working with the government of Chile, and with the operator Entel, to connect people in rural locations across the country. The goal is to provide mobile broadband and telephony services, comprising voice services (2G) as well as 3G/HSPA mobile broadband technology. In 2009, Entel and Ericsson won a USD 45 million public contract from the Chilean government to provide broadband access to between 70 and 90 per cent of the rural population.

Moreover, in August 2010 the government of Chile and Entel announced a project to extend 3G and fixed broadband services across rural areas of the country, serving public facilities, including schools and health centres, and bringing coverage to an estimated 3 million people. The project, known as “Todo Chile Comunicado,” will bring 3G wireless coverage to 1,474 rural sites, as well as extending fibre optic nodes to 12 regional centres, representing a total investment of USD 100 million; government subsidies accounted for about USD 43 million of this cost.\(^{60}\)

According to the Digital Development Indicators Report published in early 2009, there were 6,835 Chilean school facilities connected to the Internet at the end of 2008, and there were 24 students per computer.\(^{61}\) Recent projects have boosted that figure, and the objective is to provide high-quality broadband to all students, covering schools in rural or more remote areas with satellite connections, and reaching a level of 10 children per computer.\(^{62}\)

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 to school connectivity, the guidelines directed the Ministry of Education to submit annual plans for providing Internet access in schools.\textsuperscript{63}

In Malaysia, meanwhile, the government invested up to MYR 6 billion (USD 1.97 billion) between 1999 and 2010 on its \textit{ICT for Education} initiative. Most of the funds were used for computer labs to support the government’s education policy, which aims to improve English proficiency among pupils at primary and secondary schools. In 2012, the government launched the \textit{National Education Blueprint 2013-2025}, which continues to build on previous initiatives. The Blueprint aims to (1) equip 10,000 national schools nationwide with 4G Internet access, (2) establish a virtual learning platform, and (3) embed ICTs in teaching and learning for teachers, students, and parents through the expansion of the 1\textit{BestariNet} (Wi-Fi) programme to all schools.

Under the Blueprint, Malaysia has also undertaken to increase the number of ICT devices in its schools, up to a ratio of students per one device. The programme also foresees lowering the ratio, depending on the availability of funds and impact assessment. Under the 2013-2025 Programme, the government also will also pilot distance-learning and self-paced learning before scaling-up nationwide.

A \textit{School Examination Analysis System} (SAPS) will also be introduced online for 500 schools, enabling educators to monitor students’ progress. This will be part of a project to encourage partnerships among parents, community and private sector.

The government will also invest in ICT solutions for groups with specific needs such as rural schools, under-enrolled schools, and gifted students to enable cost-efficient access to high-quality teaching and learning resources.\textsuperscript{64}

Colombia has established \textit{Compartel}, a programme 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. It is expected that Compartel will deliver connectivity to the 2,288 remaining schools, mostly in rural areas, thus managing to provide connectivity to schools in 27 departments of the country.\textsuperscript{65}
In addition, the Colombian government awarded a USD 126.3 million tender for the Connectivity of Public Institutions, a project led by Compartel. This money will go to the companies Telebucaramanga, Unión Temporal Aprende Digital, Unión Temporal Internet Para Todos, Unión Temporal Colombia Digital, Media Commerce Partners, Unión Temporal Gilat Fontic and BT Latam Colombia S.A. to provide connectivity to 6,852 rural public schools.

The Computadores para Educar programme in Colombia has benefited about 6.5 million children countrywide. Since 2009, this ambitious programme has been driven by the Ministry of Education. The goal is to connect all official schools by 2014, and more than 320,000 laptops were acquired in 2012 to meet that goal.

The Computadores programme also includes a strategy to train 28,000 teachers in schools nationwide. To achieve this, a team of 2,300 ICT managers will provide training to teachers in ICT skills, in order to improve classroom practices.

Over the past decade, Portugal has defined a series of programmes to invest in educational “transformation” – i.e., to help improve education through the widespread introduction of new technologies, low-cost laptops, broadband connectivity, educational content and related training and support to schools. The programme has been part of a larger initiative to help fuel economic development and transform society.

As part of these programmes, the Technological Plan for Education (PTE) was approved in April 2007 as a national strategy to modernize Portuguese schools technologically. To achieve this, classes will be turned into interactive spaces to enable the sharing of knowledge without barriers or obstacles. Teachers, students and other school staff will be certified with ICT skills and, in addition, students will be prepared for the information society.

Within the PTE, several projects were established, including build-out of high-speed broadband Internet access for all schools, Internet access in all classrooms and school spaces, increasing the number of computers and support equipment, as well as their availability outside class periods, and building ICT competency and certification for teachers.

One project of the PTE aimed specifically at primary school children and pupils in the early years of lower secondary school. Known as escolinha, it aimed to guarantee the general use of computers and
the Internet in primary schools in order to promote access to knowledge. *e.escolinha* complements other programmes:, *e.escola* for older students, *e.professor* for teachers, and *e.oportunidades* for adults in adult education programmes.

ICT has been fully integrated into the Portuguese education system. Students and teachers have easy access to online portals, enabling knowledge-sharing and the ability to share best practices. While Internet safety is not a compulsory part of the curriculum to date, schools can access monthly competitions with an Internet safety theme through the Segura.net website, which also gives access to lesson plans containing a safety theme.\(^{70}\)

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61 Ericsson Selected for Mobile Broadband in Rural Chile. Available at: http://www.convergedigest.com/2010/12/ericsson-selected-for-mobile-broadband.html

62 Government launches broadband programme to connect for free to all schools in Chile. Available at: http://www.itu.int/ITU-D/sis/newslog/2011/05/19/GovernmentLaunchesBroadbandProgramToConnectForFreeToAllSchoolsInChile.aspx


64 *Asia Pacific Futurgov,, Malaysia launches blueprint for education system ICT reform, September 2012*. Available at: http://www.futuregov.asia/articles/2012/sep/17/malaysia-reform-education-system-ict-education-blu/


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 various regulatory tools that governments can implement to foster school connectivity. In addition, different funding mechanisms can be 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. An annotated model NSCP is attached in Annex 2.

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 bringing a strategy from the conceptual stage to the practical level. A plan should address who is in charge of coordination and implementation, 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

<table>
<thead>
<tr>
<th>Country</th>
<th>ICT for Education Policy</th>
<th>Source</th>
<th>School connectivity goal [Timetable]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolivia</td>
<td>National Policy for New Information and Communication Technologies for Schools (2005)</td>
<td>Ministry of Education</td>
<td>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 accomplishing the goals]</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Policies and Strategies on Information and Communication Technology for Education in Cambodia (2004)</td>
<td>Ministry of Education, Youth and Sport</td>
<td>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 neighbouring countries. [2004-2010]</td>
</tr>
<tr>
<td>Namibia</td>
<td>ICT Policy for Education (2005)</td>
<td>Minister of Higher Education, Training and Employment Creation;</td>
<td>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]</td>
</tr>
</tbody>
</table>
3.2 Need for coordination between 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 programmes 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.

Some countries have approached school connectivity as an integral part of the general development plan for the country, whereas others have seen e-education initiatives as more linked to connectivity and, therefore, part of ICT or telecommunications-specific strategies or initiatives. Some countries envision school connectivity as part of education policy.

Mechanisms to Implement School Connectivity Initiatives at National Level

Some of the variety of national approaches to connectivity planning can be seen in the following examples.

*ICT4D/National ICT Programmes with e-education, e-health and e-government aspects*

* These are generally driven through the prime minister’s office or an ICT Agency – in Qatar, for example, e-education is one of the programmes in the Qatar National ICT programme 2015.
E-education Initiatives

- These are primarily operated by a ministry of education – in Kenya, for example, the 2006 National ICT Strategy for Education and Training is piloted by the Ministry of Education.

Telecoms-specific initiatives and programmes, often focusing on connectivity in particular:

- Telecoms ministry – in Egypt, for example, the Ministry of Communications and Information Technology leads the nation’s ICT-based Egypt Education Initiative, in collaboration with the Ministries of Education and Higher Education.
- Universal service projects – A specific universal service agency or telecoms/ICT regulator.
- Telecoms liberalization – a telecoms/ICT regulator or policymaker introduces mechanisms such as licensing, which provide for school connectivity.

Source: Pygma Consulting International, LLC.

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. 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.
3.3 Elements of a plan

3.3.1 Key Considerations for School Connectivity

While no two countries will develop their connectivity plans in the same manner, it is crucial to implement some kind 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. Also, it is necessary to devise monitoring and evaluation mechanisms that will give the plan flexibility to adjust to changes in funding or technologies.

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:

- Identification of coordination and implementation mechanisms, including determining which government entities will be involved in implementing the plan, how stakeholders will be involved, and who will be responsible for coordination and implementation;
- Evaluation of relevant policies, laws and regulations, including identification of policies and programmes that will help or hinder broadband connectivity efforts;
- 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;
- Identification of targets and milestones, including bandwidth and deployment timelines, based on current and expected future technologies and applications;
- Identification of appropriate end-user equipment or minimum specifications for such equipment;
- Determination of whether school connectivity will be centralized and coordinated at a national level or whether it will be decentralized, with school selection taking place at different levels (national, regional and/or local);
- A network model to determine, for example, if a centralized education network, including through NRENs, is preferable to subsidization of direct connections to private ISPs;
- Identification of maintenance and support mechanisms, which may include help desks, continuous support, or outsourced technical assistance mechanisms;
- Identification of Total Cost of Ownership, which achieves two key objectives: (1) it provides an end-to-end view of the project costs, thus increasing the chances of success and sustainability; and (2) it allows for coordination of funding from numerous sources with different interests in the education and ICT value chains;
- Identification of funding sources and levels, including long-term plans for sustainability; and
- Identification of cross-cutting issues such as teacher training, child online protection, accessibility for persons with disabilities, etc.;
- Identification of monitoring and evaluation tools and project flexibility to accommodate market and funding realities.

Figure 3-2: Key Considerations for School Connectivity
3.3.2 Stakeholder Coordination

A more consolidated vision for the development of initiatives can be achieved through stakeholder coordination and discussion, as well as careful planning between various elements affecting ICT in education and the establishment of a holistic approach. Planning should take into account financial, cultural and technological elements, as well as global and regional trends. Planning should then strike a balance among these elements. Against this background, stakeholders should analyse how ICTs may be used effectively for teaching, learning and administration; consensus should be reached on such issues. The integration of ICT in education is a complex task, requiring careful planning and consultations with various stakeholders.

Different stakeholders bring different concerns and competencies to school connectivity plans. ICT stakeholders are experts in infrastructure (connectivity and accessibility), whereas education stakeholders primarily focus on budget, curriculum, professional development and research. Developments in both sectors undoubtedly affect both the sustainability and scalability of school connectivity.

On the governmental level, in addition to the Ministry of Education and the Ministry of Communications, 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 elected government leaders, ICT ministries and regulatory agencies, national planning agencies or the entity responsible for managing 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, 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, play 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 programmes.
Countries also need to consider 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**
An illustration of such collaboration can be found in Australia, where the government is investing over USD 2.1 billion to support the effective integration of ICTs in Australian schools. This is in line with the government’s broader education initiatives, including the Australian Curriculum. The National
Broadband Network (NBN) will deliver high-speed broadband connections to individual schools, homes and workplaces. The Department of Education, Employment and Workplace Relations is continuing to work closely with the Department of Broadband, Communications and the Digital Economy and school authorities to ensure that the bandwidth needs of schools are understood throughout the progressive NBN rollout process.73


### 3.3.3 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 hybrid approaches where there are national connectivity programmes funded by the government but schools have to apply for funding.

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

<table>
<thead>
<tr>
<th>APPROACH</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top-Down</td>
<td>• Guarantees uniformity in provision of connectivity</td>
<td>• Lack of direct contact between recipient schools and centralized agency may lead to gap in</td>
</tr>
<tr>
<td>Centralized agency identifies schools to be connected (e.g., primary,</td>
<td>• May provide capacity training and support to teachers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Offers economies of scale -- the government can establish</td>
<td></td>
</tr>
<tr>
<td>APPROACH</td>
<td>ADVANTAGES</td>
<td>DISADVANTAGES</td>
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<tr>
<td>----------</td>
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</tr>
</tbody>
</table>
| Hybrid   | • 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 |
| Secondary, tertiary; public, private; urban, rural | attractive agreements with service providers for connectivity, equipment, service fees maintenance, support, etc.  
• May help to prioritize which schools should receive connectivity | 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

<table>
<thead>
<tr>
<th>Bottom-Up</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
</table>
| 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 programmes | • Schools do not benefit from economies of scale  
• Integration of local connectivity solutions into eventual government-wide plan becomes more complex  
• 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 initially 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**
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. 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

<table>
<thead>
<tr>
<th>Prioritizing the schools</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior secondary school (11-12)</td>
<td>70</td>
</tr>
<tr>
<td>Junior secondary school (8-10)</td>
<td>65</td>
</tr>
<tr>
<td>Combined school (mainly secondary)</td>
<td>60</td>
</tr>
<tr>
<td>Combined school (mainly primary)</td>
<td>55</td>
</tr>
<tr>
<td>Senior primary school (5-7)</td>
<td>50</td>
</tr>
<tr>
<td>Junior primary school (3-4)</td>
<td>45</td>
</tr>
<tr>
<td>Cluster centre status</td>
<td>100</td>
</tr>
<tr>
<td>Hostel at school</td>
<td>60</td>
</tr>
<tr>
<td>Per learner</td>
<td>1</td>
</tr>
<tr>
<td>Per teacher</td>
<td>2</td>
</tr>
<tr>
<td>ratio learner:teacher &gt; 40:1</td>
<td>15</td>
</tr>
<tr>
<td>ratio learner:teacher range 30:1 to 40:1</td>
<td>10</td>
</tr>
<tr>
<td>ratio learner:teacher &lt; 30:1</td>
<td>5</td>
</tr>
<tr>
<td>no telecommunication</td>
<td>15</td>
</tr>
<tr>
<td>no electricity</td>
<td>15</td>
</tr>
<tr>
<td>remoteness &gt; 30 km from town</td>
<td>20</td>
</tr>
<tr>
<td>remoteness &gt; 20 km from town</td>
<td>10</td>
</tr>
<tr>
<td>remoteness &gt; 10 km from town</td>
<td>5</td>
</tr>
</tbody>
</table>
Schools serving specific groups, or in particular locations, have been targeted for special school connectivity programmes in some countries. In Canada, the First Nation\textsuperscript{75} SchoolNet programme 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.\textsuperscript{76} In Chile, where the majority of students are in private schools or schools funded by municipalities, the country’s Enlaces programme 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

---

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.

<table>
<thead>
<tr>
<th>School Type</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior secondary school (11–12)</td>
<td>70</td>
</tr>
<tr>
<td>Junior secondary school (8–10)</td>
<td>65</td>
</tr>
<tr>
<td>Combined school (mainly secondary)</td>
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<tr>
<td>Cluster centre status</td>
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<td>10</td>
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<tr>
<td>remoteness &gt; 10 km from town</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: Swedish International Development Cooperation Agency (Sida)
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.”

75 In Canada, the term First Nations refers to indigenous groups in the country.

3.3.4 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) programme was created in 2005 to enhance the availability of computer labs with Internet connectivity in public schools. The first phase of the programme envisaged a three year deployment timetable. It is interesting to note that a review of targets was built into the original programme, and a revision of numbers was made two years after the start of the programme (See Table 3-4, below).

Table 3-4: Timetable for Morocco’s GENIE Programme

| Year | Primary | | | Secondary | | Total |
|------|---------|---------|---------|---------|---------|
|      | %       | 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%      | 100%    | 100%     | 100%    | 633      | 8,604 |

104,000 PCs and 17,200 printers in three years.

Source: ANRT.
Initially scheduled to conclude in 2009, the GENIE programme was extended for a further four years under Digital Morocco 2013. An additional 9,260 institutions are scheduled to receive multimedia resources and Internet-enabled computers. In addition to GENIE, Digital Morocco 2013 also includes provisions to subsidize computer equipment, laptops and Internet access for teaching staff and engineering students. For the period 2009-2013, a number of goals were defined, including better coordination between the ICT and education sectors and integration of education reform goals into the GENIE programme. There also was an enhanced focus on governance, monitoring and evaluation, and ambitious goals were set to equip 9,260 schools by 2013, at an estimated cost of approximately MAD 1.172 billion (USD 149 million). In addition, the programme provided for further funds to allow an additional 200,000 teachers to benefit from ICT training and for digital content to be further developed.  

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). 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 programme in May 2009. The Internet Connectivity Project mandated that all public high schools be connected to the Internet by the end of 2010.  

78 http://www.anrt.ma/missions/service-universel/genie  
79 Moratoire pour une nouvelle stratégie nationale en matière d’intégration des technologies d’information et de communication pour l’enseignement (TICE), available at : http://www.portailtice.ma/fr/node/19  
80 Adapted from : http://www.anrt.ma/missions/genie/presentation-du-programme-genie  
3.3.5 Network details

There are various network considerations when connecting schools to the Internet.

One is the selection of the appropriate technology to integrate ICTs into educational facilities and practices. Another concern is network topology within and among the schools.

3.3.5.1 Selection of Technology to Connect Schools

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.

Schools often cannot afford Internet access, particularly in rural and remote areas. Given the importance of the integration of ICT in education, governments have increasingly assumed the responsibility of providing solutions that reduce these costs or subsidize the existing cost.

Various technologies exist and may or may not be available throughout the country. The different technologies may have different costs. For example, satellite broadband technology has a different cost profile than does terrestrial mobile broadband. In rural areas, networks may generally be available, but additional costs may be incurred to bring connectivity to the school. The availability of technologies, along with their speed and accessibility, must be balanced with costs, all of which bear upon the sustainability of the project. Appropriate speeds need to be identified along with the selection of high-speed technology. However, alternatives to high-speed connectivity cannot be ignored, because they still can be useful in integrating ICT in education, particularly where broadband connectivity is still a challenge.
There are several technologies for Internet 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 fibre-optic connections, although these options may not be available or affordable in many developing countries.

Broadband wireless technologies such as WiMAX, or third generation mobile or satellite Internet access are possibilities wherever fixed lines are unavailable. 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

<table>
<thead>
<tr>
<th>Technology</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dial-up</td>
<td>Most common narrowband connectivity option; uses existing telephone network. Can incur significant costs if telephone usage charges must be paid.</td>
</tr>
<tr>
<td>ISDN</td>
<td>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.</td>
</tr>
<tr>
<td>Technology</td>
<td>Comment</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>GPRS</td>
<td>Mobile technology using GSM networks providing narrowband access at speeds roughly similar to dial-up.</td>
</tr>
<tr>
<td>EDGE</td>
<td>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.</td>
</tr>
<tr>
<td>W-CDMA</td>
<td>A third-generation (3G) mobile technology providing speeds up to 384 kbps.</td>
</tr>
<tr>
<td>HSDPA</td>
<td>A broadband 3G mobile technology.</td>
</tr>
<tr>
<td>EV-DO</td>
<td>A 3G mobile cellular broadband technology based on CDMA2000. Being used to connect schools in Guatemala and Indonesia.</td>
</tr>
<tr>
<td>DSL</td>
<td>Used by schools in a number of countries. Requires telephone line connection.</td>
</tr>
<tr>
<td>Cable modem</td>
<td>Provides broadband over cable television networks. Not widely deployed in developing countries.</td>
</tr>
<tr>
<td>Ethernet</td>
<td>Local Area Network (LAN) technology. A wired alternative to Wi-Fi.</td>
</tr>
<tr>
<td>Fibreoptic</td>
<td>Provides very high bandwidth but costs significantly more than other options. Generally used in tertiary institutions and urban schools in developed countries.</td>
</tr>
</tbody>
</table>
### Technology

<table>
<thead>
<tr>
<th>Technology</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Wireless Access</td>
<td>Provides wireless Internet access using proprietary technology. Macedonia has connected all of its schools using fixed wireless access technology.(^\text{87})</td>
</tr>
<tr>
<td>Wi-Fi (802.11)</td>
<td>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.</td>
</tr>
<tr>
<td>WiMAX (802.16)</td>
<td>Used by schools in several countries including Nigeria(^\text{88}) and the Philippines.(^\text{89})</td>
</tr>
<tr>
<td>VSAT</td>
<td>Satellite technology generally used to provide Internet access to rural schools. Examples include Argentina, Malawi and Thailand.</td>
</tr>
</tbody>
</table>

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.


\(^\text{84}\) A detailed account on the use of wireless technologies for connecting schools in Namibia see: [http://schoolnet.edunet-namibia.org/projects/wireless/snetwireless.pdf](http://schoolnet.edunet-namibia.org/projects/wireless/snetwireless.pdf)


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. This is particularly true in countries where users have to pay telephone usage charges for dial-up connectivity. Dial-up is also not a good solution for redistributing access within schools.

Some countries, such as Chile, have established programmes for migrating narrowband-connected schools to broadband connections. 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. 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
3.3.5.1.2 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. 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.” 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;

- Ireland: 100 Mbps for post-primary schools;
- United Kingdom: 2, 5, 10 or 100 Mbps for schools in London.\footnote{5}

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

\footnote{1}{“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.}

\footnote{2}{Case Study on ICT integration into education in Malaysia: “The Malaysian Smart School Project.”}

\footnote{3}{Australian Department of Education, Employment and Workplace Relations, “High Speed Broadband to Schools Overview” at \url{http://www.deewr.gov.au/Schooling/DigitalEducationRevolution/HighSpeedBroadband/Pages/HighSpeedBroadbandToSchoolsOverview.aspx}}

\footnote{4}{Irish Department of Communications, Energy and Natural Resources. Schools 100 MBS Project, \url{http://www.dcenr.gov.ie/Communications/Communications+Development/Schools+Broadband+Access+Programme/}}

\footnote{5}{\url{http://www.lgfl.net/about/Pages/default.aspx}}

### 3.3.5.1.3 Mobile Technologies

A recent GSM Association report defines \textit{m-education} as:

\begin{quote}
\textit{“Technology-enabled learning solutions available to learners anytime, anywhere. Any portable device, such as a tablet, laptop or mobile phone, that provides access to educational content through mobile connectivity (2G, 3G, or 4G complemented by mobile-based Wi-Fi) can be a tool for mEducation.”} \footnote{6}
\end{quote}

The same report cites three advantages of m-education, in terms of the potential education delivery and learning outcomes:
M-education simplifies access to content and experts, overcoming traditional constraints of time, location and collaboration;

It personalizes education solutions for individual learners, helping educators customize the teaching process, using software and interactive media that adapt levels of difficulty to individual students’ understanding and pace; and

It addresses specific challenges that lower the efficiency of educational systems worldwide.  

There are numerous examples of how mobile networks have contributed to providing school connectivity. As part of the Schools for the Future Programme in Guatemala, for example, rural schools were supplied with wireless Internet connectivity through Telgua’s 3G network. The project included 15 schools within the regions of Alta Verapaz, Escuintla, Petén, Huehuetenango, San Marcos and Izabal. The project called for infrastructure improvements comprising 17 computers per school, high-speed 3G wireless connectivity, teaching software and training. The expanse of the project covered the country from the north to the southwest and included coastal and inland areas.

Many companies and countries are also using social media to enhance education among school children. Enhancing education through social networking is expected to help reduce the significant numbers of school-age children in developing countries who are not receiving any formal education. Nokia launched MoMath, a mathematics teaching tool that targets users of the instant messaging platform Mxit. Mxit is South Africa’s most popular social media platform, with more than 10 million active users in the country.

Mobile technology is increasingly helping address limitations of education in two areas: access and personalization. Mobile networks and devices go beyond connecting schools -- they can enable teacher and student connectivity. Mobile phones are cheaper to own and easier to run than PCs. Not surprisingly, they are gaining ground as tools for delivering teaching content. Many mobile devices are now also equipped with Wi-Fi connectivity, as well as cellular connectivity, enabling consumers to use the best (and/or cheapest) connection available to them at any given time.

Like e-education, m-education allows students and teachers to access locally and globally relevant content, and they can share that content with other students and teachers anywhere. As illustrated by 2012 ITU data, mobile networks cover almost 90 per cent of the global population today, creating an unprecedented platform to increase the availability of education.
Wireless bandwidth, combined with modern mobile devices such as smartphones, offer even more opportunities to schools. These devices are transforming the world in two ways: functionality and availability. As prices fall, the devices become available to more low-income users, making them interesting solutions to be considered in school connectivity plans.


99 https://projects.developer.nokia.com/Momaths


3.3.5.1.4 Satellite Broadband

Satellite Broadband is recognized today as a necessary addition to technology options, especially in remote and rural areas. In Europe, for example, the European Digital Agenda has set a target of 100 per cent broadband coverage by 2013, recognizing that satellite broadband will be required to achieve this ambitious goal. Terrestrial fixed broadband network coverage stood at around 95 per cent in 2011, while satellite coverage in Europe is universal. By 2013, the entire EU population is expected to have access to some kind of commercially viable broadband service, fulfilling one of the Digital Agenda targets. 101

In the Cyprus Republic, the Ministry of Communications and Works announced in March 2009 that all villages in the country will be covered by satellite Internet access, in combination with Wi-Fi coverage. This combined service will be open and free to the people of those villages. 102
In Colombia, the Ministry of Information Technology and Telecommunication (MINTIC) is using satellite broadband service to provide broadband Internet connectivity to more than 1,600 schools throughout the country’s rural regions. Valued at approximately USD 18.5 million, the project is hosted by the Ministry’s Social Telecommunications Programme (“Compartel”) and the "Fondo de Tecnologías de la Información y las Comunicaciones." It is scheduled to be carried out through 2013. The network is expected to connect schools located in five separate districts across rural Colombia, and is part of a national tender, covering 6,800 schools, which was awarded to seven operators. The programme is part of the Colombian government's ongoing efforts to reduce the communication gap and promote further investment in improved access to advanced communications services in schools.  

As part of its nationwide “Genie” programme to modernize ICT capabilities in schools, the government in Morocco has also opted for a satellite-based broadband service to schools that are beyond the range of terrestrial networks. Morocco plans to include 470 schools, complementing ADSL and 3G network services across the country.  

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102 Connecting blank rural areas through satellite broadband. Available at: “Connecting blank rural areas through satellite broadband” PowerPoint


### 3.3.5.2 School network topologies

**Establishing School Networks**

Instead of supplying each school with its own direct Internet access service, some countries have found it more beneficial to create school *intranets* that connect educational institutions to an academic
network. Such school networks allow educational institutions to be linked within a country or region, providing a way for the schools to exchange educational materials. The networks also improve administrative processes among schools within a single jurisdiction or school district and allow better access to education ministries.

A school network can reduce Internet access charges by keeping academic traffic local rather than having it routed overseas. Network links can be extended to overseas networks or NRENs. Given the limited bandwidth of dial-up access, a school network often is a better option for a single school, which otherwise might have to secure 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.

A school network also provides connectivity and access to high-quality, centralized and localized digital content for both teachers and students. Plus, the network generally provides access to educational applications, content filtering, anti-virus, centrally hosted secure email, and online security services.

The advantages of connecting through a central school network are:

- **Speed** – Once the schools are connected, the school network will provide a rapid method for sharing and transferring files. Without a network, files are often shared by copying them to memory sticks (which have a cost) and manually transferring information, which is time-consuming and restricts sharing of information across the school and eventually several schools nationally.

- **Cost** - The network versions of most software programmes are available at considerable savings when compared to buying individually licensed copies. In addition to providing monetary savings, sharing a programme on a network allows for easier upgrading of the programme. The changes have to be done only once, on the file server, instead of on all the individual workstations.

- **Centralized Software Management** - One of the greatest benefits of installing a network at a school is the fact that all of the software can be loaded on one computer (the file server) and shared.

- **Resource Sharing** - Sharing resources is another area in which a network exceeds stand-alone computers. Through networking, the costs of peripheral equipment (printers, modems, scanners) will be reduced, since they can be shared across the network.
• **Flexible Access** - School networks allow students and teachers to access their files from computers throughout the school, and eventually, throughout the region or country.

*Other Solutions*

In addition to school networks, there are other scenarios to bring connectivity to schools:

• Purchasing a direct Internet connection from a commercial Internet Service Provider;

• Establishing a direct connection via a National Research and Education Network (NREN) or Regional Research and Education Network (RREN);

• Getting a mix of connections provided by telecommunications operators, commercial Internet service providers and NRENs;

• Establishing connections through government-owned fibre backbone networks; or

• Getting connected via a regional or metropolitan-area network. ¹⁰⁵

NRENs consist of human networks and their accompanying organizational structures, as well as the supporting infrastructures. NRENs can connect universities and research centres directly, apart from the commercial Internet, providing uncongested, high-speed advanced communications capabilities. NRENs are increasingly viewed as the vital and core component of modern teaching, research and learning. About 100 countries around the world have adopted NRENs as the centrepieces of their information and communication technology (ICT) plans for tertiary education. Potential users include educational institutions, hospitals and other health-related facilities, government agencies and ministries, libraries, research institutions, museums, science and technology institutions, as well as offices involved in culture, tourism and agriculture. In short, any institution a “community of interest” can use NRENs. For example, the Academic and Research Network of Slovenia (ARNES) connects universities, institutes, research laboratories, museums, schools, databases and digital libraries in the country. The network links more than 1,000 Slovenian organizations, making the ARNES services available to nearly 200,000 people. ¹⁰⁶
In the Republic of Ireland and in England, network connectivity for schools is provided by telecommunications operators, but schools also receive a connection to the NREN and therefore benefit from the services that the NREN offers.

In the U.S. state of North Carolina, charter schools are now receiving high-speed connectivity and services on the North Carolina Research and Education Network (NCREN). Access for charter schools is part of the North Carolina School Connectivity Initiative (SCI), begun in May 2009, for all 115 K-12 public school districts in North Carolina to be connected to NCREN. North Carolina charter schools are eligible to be connected to NCREN either through a complete turnkey connection or by opting to be responsible for part of the connection arrangements themselves. Each charter school connected to NCREN receives the same quality broadband connection, equipment, and support as the school districts that already are connected.\(^\text{107}\)

In England, 10 regional bodies (\textit{regional broadband consortia}) were created to procure connectivity on an “aggregated” basis for all the schools in their region. By procuring on a bulk basis, the consortia are able to negotiate significant discounts on the price that individual schools are not able to obtain. Each consortium is free to obtain connectivity from any telecommunications operator, and it is encouraged to find the best value for its member schools.\(^\text{108}\)

In Djibouti, the \textit{Connect to Learn} project uses cloud-based technology to connect schools. The project was launched in 2012 by Ericsson, in collaboration with Djibouti Telecom, the Ministry of Telecommunication and the Ministry of Education. The project so far has connected five schools, allowing some 1,300 students and teachers to have access to laptops, projectors, broadband connectivity and online educational resources. \textit{Connect to Learn} is a collaborative effort between Ericsson, the Earth Institute at Columbia University (in the United States) and Millennium Promise. It is based on the use of connectivity to implement low-cost and user-friendly ICTs for schools through mobile broadband and cloud computing. The project is designed to give students and teachers access to information and educational resources, as well as the ability to connect their schools with others around the world, enabling collaborative learning, cross-cultural understanding and global awareness.\(^\text{109}\)

In Ireland, telecommunications operators had to bid for contracts to provide connectivity for schools. Six providers won contracts, with the condition that they support free mobile learning services. Learning devices are no longer restricted to the classroom -- many students, of all ages, own or have
access to cell phones, iPods, tablets, or other handheld devices. School administrators are quickly realizing that students can use those devices to access school websites, classroom assignments, and other educational resources from both school and home.¹¹⁰

A 2011 Economist Report indicates that there are already 84 million Internet-enabled mobile devices in Africa. A predicted 69 per cent of mobile devices in Africa will have Internet capability by 2014. ¹¹¹ Similarly, 2012 ITU data shows that the number of mobile phones worldwide approached 6 billion at the end of 2011. ¹¹²

For every individual who goes online from a computer, two more do so from a mobile device. Even where schools and computers are scarce, people still have mobile phones. Growth in mobile services has been driven by developing countries, which accounted for more than 80 per cent of the 660 million new mobile-cellular subscriptions added in 2011. Africa alone will account for some 735 million mobile subscriptions by late 2012. This means that a majority of Africans have individual access to an interactive ICT -- for the first time in history.

This is also the case in the Asia-Pacific region. In 2011, for example, 142 million mobile subscriptions were added in India, twice as many as in the whole of Africa, and more than in the Arab States, CIS and Europe together. By the end of 2011, there were 105 countries with more mobile subscriptions than inhabitants, including African countries such as Botswana, Gabon, Namibia, Seychelles and South Africa. Countries where mobile service penetration increased the most in 2011 included Brazil, Costa Rica, Kazakhstan, Lao P.D.R. and Mali. In 2011, 144 million mobile broadband subscriptions were added in the so-called BRICS nations (Brazil, the Russian Federation, India, China and South Africa), accounting for 45 per cent of the world’s total new subscriptions in 2011.¹¹³

Although there is often resistance to the use of mobile phones in classrooms, there are also multiple examples of how mobile technologies have contributed to school connectivity. Given the tremendous expansion of mobile broadband and the increased availability of smartphones around the world, the use of such technology for school connectivity must be addressed.

In France, schools are connected via a regional network that, in turn, is connected to the NREN. In most regions, the regional school administration organizes school connectivity, with traffic from the schools network then being injected into the NREN backbone at the regional level. Countries deploying...
national backbone networks should also plan for backhaul to allow for school connectivity. This can be done at no or low cost, including the use of wireless backhaul.

The network topology within schools also needs to be established. 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**

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105 Sabine Jaume-Rajaonia and Karel Vietsch (editors), Andrew Perry, Catalin Meirosu, Christina Wanscher, Henrik Søndergaard, Martin Bech, Report on Requirements of Users in Schools, the
3.3.6 Maintenance and 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 needs 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.\(^\text{114}\) In Mexico, Networking Academy graduates have been providing technical assistance to Internet-connected primary and secondary schools.\(^\text{115}\)

Outsourcing network maintenance is another option. In Jordan, the Ministry of Education has a contract with a local firm to support all connected schools.\(^\text{116}\)

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

\(^{114}\) http://www.cisco.com/web/learning/netacad/academy/index.html


\(^{116}\) http://linc.mit.edu/conference/presentations/toukan.ppt

### 3.3.7 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.

The benefits of market liberalization increase as more service providers enter the market and competition intensifies. However, not all the countries that have introduced a legal framework for a liberalized ICT market have succeeded in creating true competition. Continuing problems may stem from regulatory barriers to entry, including exclusivity clauses in the licenses held by existing operators, as well as ineffective or incomplete regulations on spectrum management, universal access,
interconnection and even numbering. Competition in international connectivity (i.e., sub-marine cables) and access to services such as international and Internet gateways is key to lowering the cost of bandwidth and broadband prices for consumers. It is important to establish effective interconnection and gateway regulatory frameworks that introduce new models of sharing and collocation and reduce barriers to existing private, government and international networks. Effective reforms along these lines can encourage existing providers and new market entrants to expand into broadband and other services.

Recognizing the importance of ICTs, the Moroccan government in the 1990s created an enabling regime for the telecommunications sector that embodied concrete liberalization and privatization measures. This led to the reduction of telecommunications costs and resulted in a rise in the number of cyber cafés and access to computers and Internet, even in small towns. One benefit was the integration of ICTs into education.

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.

3.3.7.1 Universal Access and 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 access and service programmes in order to increase access to ICTs, particularly in rural and other unserved and underserved areas. In some cases, universal access and service programmes have been targeted directly at schools.
### 3.3.7.1.1 Universal access and service funds

Many countries have established *universal access and service funds* (UASFs) that are generally financed from one or more of the following sources:

- Governments’ general budgets (this is the case in only a small minority of cases, including one of the first funds, Chile’s *Fondo de Desarrollo de las Telecomunicaciones*);
- Industry levy, as a percentage of annual revenue, on certain classes of licensees;
- Various other regulatory sources such as the proceeds of license competitions, frequency spectrum auctions and fees; and
- Once-only contributions from government, financed by loans or grants from international donors such as the World Bank, which contribute seed funding to assist UASF start-ups in their early years. 117

The UASF is often used for general objectives such as installing telecommunications networks in rural areas. More recently UASFs are increasingly being targeted to particular sectors such as schools.

Although in most countries the majority of UASF funds come from annual operator levies, all potential sources should be considered, particularly where funding of school connectivity is considered.

How the UASF 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 UASF. In other countries, the UASF is used to reimburse designated operators that deploy infrastructure in targeted areas. In some instances, the UASF is used to subsidize tariffs for specific groups.

In Latin America, many countries have established UASFs aimed at increasing access to telecommunications services in un-served or underserved areas. Some of these funds include specific provisions for school connectivity. When countries review their universal service/access programmes or legislation, they could update the authorizing documents to make it easier and more flexible to provide UASF funding to cover the costs of school connectivity and equipment.

Ecuador’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 Telecommunicaciones, or CONATEL) is responsible for developing an annual plan that identifies universal service targets for funding from FODETEL, the country’s universal service fund.\footnote{118} FODETEL has financed a number of school connectivity programmes, including a USD 469,000 project providing broadband connections and free Internet access to 74 schools in the Cantón Montúfar Municipality.\footnote{119}

\footnote{117} infodev ICT Regulation Toolkit. Available at: http://www.ictregulationtoolkit.org/en/Section.3275.html
\footnote{119} IMPLEMENTACIÓN DE LA RED DE CONECTIVIDAD Y CONTENIDOS PARA EL

### 3.3.7.1.2 Universal Service Obligations and Providers

An alternative to creating a fund for expanding telecommunications access in un-served 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. 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. \(^{120}\)


### 3.3.7.1.3 Coordinating universal service

Universal access and 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 access and 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 and which also enables budgetary funding from the ministry of education to be allocated for school connectivity. In addition, there should be a way to address the needs of schools that will not be connected with universal service funding.

### 3.3.7.2 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.

### 3.3.7.2.1 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. The FCC restructured the programme in 2004, allowing educational institutions to use this spectrum for so-called Educational Broadband Services (EBS), in addition to broadcast transmissions.


### 3.3.7.2.2 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. To assist with MALICO’s project, the Malawi Communications Regulatory Authority (MACRA) waived most of the VSAT fees in order to reduce the programme’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 programme was delivering 1 Mbps via uplink and 256 kbps on the downlink to four universities and colleges.

In Peru, the Viettel Group was awarded a license in 2011 in the 1900 MHz band to provide fixed mobile services in Peru. Under the terms of this license, Viettel undertook to provide free broadband Internet access for 10 years to 4,045 public schools, with an investment of USD 1.3 million. Viettel outbid Americatel (which offered 2,011 schools and USD 1.3 million) and Winner Systems (which offered 1,601 schools and USD 1.3 million). 123

In August 2012, Viettel Peru SAC, won an additional mobile license, under which it has undertaken to provide services to at least 15,000 subscribers in its first year of operation and 357,000 more users within five years. Under the terms of the second license, Viettel must invest at least USD 300 million in installing signal reception and transmission stations, fibre optic cables, and other equipment required to achieve the target. Viettel was awarded the 20-year contract largely due to its commitment to provide free Internet services to 718 schools in Peru within the first 10 years. Viettel also committed to providing mobile services to 48 districts in Peru’s rural areas. 124


123 : http://www.itu.int/ITU-D/sis/newslog/2011/01/30/
VietnameseCompanyOfferedToProvideFreeInternetAccessToMoreThan4000PublicSchoolsInPeru.aspx

viettel-wins-telecom-contract-in-peru-225995

3.3.7.2.3 Unlicensed spectrum

Unlicensed spectrum refers to radio frequency bands that may be used without a licence. 125 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. 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.

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


### 3.3.7.3 Licence 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 launched the *National Rural Telecommunications Program in 2009*, which is intended to increase Internet access for rural populations. The programme 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 programme. ANATEL, the country’s telecommunication regulator, will have the task of devising measures to implement the directive.

Brazil also provides an example of modifying licence conditions in favour of school connectivity. The Ministry of Communications developed its *Broadband in Schools* programme 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 favour 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 programme and 100 per cent of these schools must be covered by the end of 2010.\textsuperscript{128}

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.\textsuperscript{129}

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.\textsuperscript{130} The implementation of these obligations depends on the Ministry of Education acting to identify the schools to be connected.


\textsuperscript{128} http://portal.mec.gov.br/index.php?option=com_content&task=view&id=10264


\textsuperscript{130} http://www.vodacom.com/education.php

\subsection*{3.3.7.4 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.\textsuperscript{131} In the Maldives, incumbent operator Dhiraagu provides lower broadband tariffs to schools through a special arrangement with the Ministry of Education.\textsuperscript{132}
3.3.7.5 International gateway access and access to national backbone infrastructure

One of the main drivers of the cost of international calls and Internet access is the cost of international connectivity, as determined by physical access to satellite and submarine fibre-optic cables. Competition in the international market is an essential element to reduce those costs.

The cost of satellite connectivity remains high, yet many countries around the world still lack access to submarine cables, either because they are landlocked, because they have not yet connected to an available cable, or because none is available (e.g. in the Pacific Islands). Landlocked countries may be able to negotiate a “virtual coastline” -- the possibility of owning and operating a cable landing station in a neighbouring country’s territory. Still, they must depend on the existence of affordable access to infrastructure to and within that country in order to transit their traffic.

Studies have shown that countries with access to submarine cables generally have lower international call prices. And where competitive access has been introduced, prices are generally significantly lower than in those countries that have retained a gateway monopoly.

Such studies have also shown that although access to high-capacity submarine fibre-optic infrastructure is a significant factor in lowering the cost of international voice services, it is not sufficient. Countries also need to ensure competition in the international facilities segment of the market, in particular, if services are to become more affordable and accessible. Also, where there is insufficient infrastructure for national backhaul, prices remain high and accessibility is limited.

Competition in international connectivity (i.e., sub-marine cables and satellite connectivity) and access to services such as international and Internet gateways is key to lowering the cost of bandwidth and broadband prices for consumers. If countries liberalize their access to gateways and allow multiple international access providers (e.g. multiple sub marine cables, a mixture of cables and satellite, etc.), the cost of commercial Internet access will drop. That means schools that have to pay commercial
rates will pay less, and universal access and service funds subsidizing costs will also have to disperse less money – or those programmes will be able to serve more areas or end users.

It is not enough to have more infrastructure and international access. The introduction of more options in terms of international connectivity must be accompanied by effective interconnection and gateway regulatory frameworks that introduce new models of sharing and collocation and reduce barriers to existing private, government and international networks. Such frameworks are essential in allowing existing and new market entrants to expand into broadband and other services.

As stated in a 2008 ITU Trends in Telecommunications Report, lower prices, increased demand and enhanced international capacity are linked. A combination of all of these market forces may be needed for developing countries to reach their development goals, including introducing ICTs in schools and attaining the important goal of providing connectivity to schools.

Likewise, regulatory frameworks that allow for free or low-cost access to national fibre backbones are essential to facilitate school connectivity. As stated in the 2008 ITU Trends in Telecommunications Report, while competition at the international level has often driven down the price of bandwidth, national bandwidth prices in developing countries are set by one or two providers and, as a result, often remain high. Access to a national broadband fibre network is as important a priority as building an effective national transportation network.

Increasingly, regulation addressing the sharing of infrastructure by telecommunication operators is focused on two broad issues that are often viewed as the stumbling blocks to speedy roll-out of national telecommunication infrastructure. First, there is the need to open up access to “bottleneck” or “essential” facilities, where a single dominant infrastructure operator provides or leases facilities. Second, there is a need to promote market investment in high-capacity infrastructure to un-served or under-served areas. This too can have an influence on school connectivity.

It may be sufficient to revise licensing frameworks to authorize one or more new entrants to enter the backbone market and to work with local government officials to secure rights-of-way to lay the fibre backbone network. Local governments could be encouraged to provide rights-of-way, for example, in exchange for connecting schools and hospitals to the high-speed backbone network. 134
3.3.7.6 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 multiple 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.

### 3.4 Total Cost of Ownership, Funding and Sustainability

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”).

3.4.1 Total Cost of Ownership

An effective school connectivity plan must take into account the total cost of ownership (“TCO”), which is depicted in the diagram below. Educational objectives, actors and funding must be channelled to address the key steps that complement each other. These steps include the cost of deploying the infrastructure platform. Platform costs include more than the simple cost of acquiring computers and connectivity for schools. They also include the cost of accessing electricity where there is no access to the main electricity grid, as well as the cost of replacing equipment. Hardware and software, peripherals, the cost of security and electricity, are also factors. There are also costs for providing and maintaining content and applications, providing and ensuring continued user training and support, maintenance and technical support and the monitoring and evaluation of the project.

Figure: Total Cost of Ownership
In many cases, computers and other ICT equipment are provided through grants, donations or other sponsorship, but other costs, such as access to, and supply of, electricity, continued long-term, good-quality connectivity, training and maintenance have not been factored in. The absence of a holistic approach threatens the viability and sustainability of the project.

Access to power is essential for connectivity, yet extending electricity supplies to remote and rural areas is often expensive, entailing high installation, supply and distribution costs. Generators and solar panels also have their costs for installation and maintenance.

A recent programme driven by the Organización de Estados Iberoamericanos (OEI) (Organization of Iberoamerican States), called "Lights to learn," proposes to connect to the electricity network and provide Internet access to more than 62,000 rural and difficult-to-access schools. The initiative is based on the understanding that electricity is essential to providing the basic conditions required for teaching and for the use of ICTs. In 2012 the OEI will install pilot solar panels in at least 100 schools in each country involved in the “Luces para aprender” initiative, with the first being installed at the indigenous Itajeguaca School in Paraguay. The aim is to provide solar panels to the more than 60,000 schools that lack a power supply by 2014. The system will cost close to EUR 4,200 per school, amounting to a total cost of EUR 260 million.

In addition, provisions must be made for the sustainability of the project. This will involve other sources; government and donor funding cannot be the only source of revenue for nation-wide coverage of schools. Schools are generally encouraged to devise funding strategies for long-term sustainability of school connectivity.


### 3.4.2 Funding

While connectivity costs can be substantial, 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, regional, 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.

### 3.4.2.1 Government funding

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 Centre for Education and Technology, known as Enlaces. Administered by Chile’s Ministry of Education, Enlaces established the Funds for Broadband programme in 2004. Through this programme, 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 per cent of these have access to broadband. In 2008, 2,644 schools were granted funds for broadband Internet connectivity.\textsuperscript{136} Chile’s \textit{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.

In 2011, the Chilean Minister of Transport and Telecommunications, Pedro Pablo Errazuriz, and the Minister of Education, Joaquin Lavin, announced their commitment to have all educational establishments connected to broadband networks by 2012, including schools in rural or more remote areas, which are connected through satellite. By 2011, Chile had reached a level of 10 children per computer. The programme was enhanced with an investment of USD 7 billion in 2011, and a similar public investment was earmarked for 2012 through the Global Telecommunication Development Fund. The aim was to increase the number of connected schools, which at that time amounted to 5,600 schools. The 2011 Plan aimed to raise the standards of these schools, and to connect the schools that were not yet connected, thus reaching more than 11,600 schools.\textsuperscript{137}

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.\textsuperscript{138}

\textsuperscript{136} Centro de Educacion y Tecnologia – Enlaces, Ministério de Educacion, available at:
http://portal.enlaces.cl/?t=44&i=2&cc=1278&tm=2

\textsuperscript{137} http://www.itu.int/ITU-D/sis/newslog/2011/05/19/GovernmentLaunchesBroadbandProgramToConnectForFreeToAllSchoolsInChile.aspx

\textsuperscript{138} http://former.deped.gov.ph/cpanel/uploads/issuanceImg/DO%20No.%2050,%20s.%202009.pdf

\subsection*{3.4.2.2 Telecommunication 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: Telecommunication operator projects for school connectivity, selected countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antigua and Barbuda</td>
<td>Digicel</td>
<td>Digicel, in partnership with the Government of Antigua and Barbuda, will deliver broadband Internet service for free to communities and schools across the twin-island nation under an initiative – entitled “Technology for Communication, Education and Empowerment.” The project will use Wi-Fi technology to bring broadband Internet access into 3,000 homes across the communities of Grays-Green, Yorks, and Lower Gambles, as well as more than 5,000 secondary school students. Digicel is partnering with the government to provide community computer access centres in 12 secondary schools, which will include the physical infrastructure, as well as the furniture and air-conditioning. Each of these community access centres will accommodate at least 20 students. 139</td>
</tr>
<tr>
<td>Country</td>
<td>Operator</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Belize</td>
<td>Belize Telemedia Limited (BTL)</td>
<td>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.</td>
</tr>
<tr>
<td>Chile</td>
<td>Compañía de Telecomunicaciones de Chile (CTC)</td>
<td>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.</td>
</tr>
<tr>
<td>Germany</td>
<td>Deutsche Telekom</td>
<td>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 schools, about 30,000 have a DSL broadband connection.</td>
</tr>
<tr>
<td>Jamaica</td>
<td>LIME</td>
<td>In 2012, the LIME Jamaica Foundation partnered with the Ministry of Education to give 300 primary schools across the island free Internet service over the next three years, which is expected to benefit more than 200,000 students. The LIME Jamaica Foundation’s mandate places great priority on providing exposure to the best in ICTs to the youth of Jamaica.</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>Slovak Telekom</td>
<td>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.</td>
</tr>
<tr>
<td>Country</td>
<td>Operator</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td>Uruguay</td>
<td>Antel</td>
<td>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.(^{145})</td>
</tr>
</tbody>
</table>

Footnote: [http://www.carib-is.net/node/366](http://www.carib-is.net/node/366)

\(^{139}\) [http://www.belizetelemedia.net/education2.php](http://www.belizetelemedia.net/education2.php)


\(^{143}\) [http://spectator.sme.sk/articles/view/17510/3](http://spectator.sme.sk/articles/view/17510/3)


### 3.4.2.3 Multilateral, regional 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, the 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 and regional 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.\(^\text{146}\) 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.”\(^\text{147}\) 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.\(^\text{148}\)

- The Asian Development Bank helped to fund the *Sri Lanka Secondary Education Modernization Project*, which ran from 2000 to 2007.\(^\text{149}\) The project included a component for creating over 1,000 "computer learning centres" in secondary schools. The centres include Internet access.\(^\text{150}\)

- 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.\(^\text{151}\) 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.\(^\text{152}\) In addition, the IDB assisted with funding of several school computer programmes 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. More recently, the IDB has
supported loans for the educational expansion and consolidation of Plan Ceibal in Uruguay. IDB also is starting the programme Educatrachos in Honduras. With grant support, IDB has developed important pilots in Costa Rica (development of "XXI century skills"), Colombia (teaching strategies in the context of "one-" one-to-one" programmes) and in Brazil and Chile (personalized education programmes within and outside schools, using technology and connectivity). Finally, the Bank supported the creation of the Latin American Network of Educational Portals (RELPE), which is an important initiative for the collaborative production of digital educational resources.

• The European Union supports the construction of broadband infrastructure and Internet take-up through both rural development and structural funds, and has clarified the application of state aid rules on use of public funds for broadband deployment. In the 2007-2013 programming period, EUR 1.02 billion was added to the Fund for Rural Development (EAFRD), and of this money, EUR 360 million was programmed on broadband projects. Within this context, in January 2012, the Romanian Ministry of Communications and the Ministry of Education signed a financing contract for European structural funds that will provide broadband Internet connections to more than 2,446 schools in rural areas and small towns. This will require an investment of approximately EUR 30 million. The main objectives are to provide broadband Internet connections to the schools, giving Internet access to approximately 650,000 students and about 48,000 teachers in disadvantaged areas. There will also be technical support for all schools involved in the project.153

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.154

• 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-2001.155

• 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 programme, which led to the provision of wireless broadband access to all of that
country’s primary and secondary schools.\textsuperscript{156} It also helped with financing of a high school connectivity project in Yemen, with a focus on girls’ access to ICTs.\textsuperscript{157}

\begin{itemize}
\item \textsuperscript{146} http://web.worldbank.org/external/default/
main?pagePK=64027221\&nPK=64027220&theSitePK=315130&menuPK=315162?ojectid=P075829
\item \textsuperscript{147} http://siteresources.worldbank.org/EDUCATION/Resources/278200-1121703274255/
1439264-1245102696247/Russia_E-Learning_Support_Project.ppt
\item \textsuperscript{148} http://www.unites.org/world.htm
\item \textsuperscript{149} http://www.adb.org/Documents/PCRs/SRI/33245-SRI-PCR.pdf
\item \textsuperscript{150} http://www.schoolnet.lk/index.php?lang=en\&for=default\&page_id=38
\item \textsuperscript{151} 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
\item \textsuperscript{152} http://www.mes.gov.bb/pageselect.cfm?page=89
\item \textsuperscript{153} http://www.romania-insider.com/eu-funds-to-connect-over-2400-rural-romanian-schools-to-the-internet/46616/
\item \textsuperscript{154} http://www.mofa.go.jp/policy/economy/it/asia/coop0107.html
\item \textsuperscript{155} http://schoolnet.edunet-namibia.org/news/stories/sidaphaseii.html
\item \textsuperscript{156} http://macedonia.usaid.gov/en/sectors/education/mk_connects.html
\item \textsuperscript{157} “The Yemeni High School Internet Pilot Project.” \textit{DOT-COMments}. December 2005.
\end{itemize}

\section{3.4.2.4 Private sector}
Some private-sector companies, mainly in the high-tech arena, provide support for educational connectivity.

Through its \textit{EducaRed} programme, 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 programme 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 programme 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.  

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.

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

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. The Intel World Ahead Programme aims to invest over USD 1 billion to improve Internet connectivity, education, and overall computing accessibility in the developing world. Its five-year objectives for the programme include training 10 million teachers to use technology in education, and to provide schools with wireless broadband connectivity. The company has built three computing platforms for developing markets; by employing local service providers and computer manufacturers, Intel is able to sell these systems for 20 per cent below developed-world prices. Intel is also working with New Partnership for Africa’s Development (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 programmes in Nigeria to encourage purchase of PCs for home use and to train teachers to incorporate technology into instruction.
Meanwhile, Cisco also contributed to the NEPAD e-Schools project by contributing both people and financial resources to implement ICTs in educational institutions across the continent. Additionally, a dedicated Cisco Fellow relocated to Africa to lead a consortium that trained teachers and administrators so that each participating school could make full use of these new capabilities and create a self-sustaining model. By 2008, Cisco’s NEPAD participation benefited 58 schools and approximately 30,000 students. Cisco installed networking equipment for Internet access and satellite connectivity in several schools.162

Cisco led a consortium of companies in this project, in which it promoted the installation of networking equipment for Internet access and satellite connectivity in schools in Algeria, Ghana, Mauritius, Rwanda, Senegal, and South Africa. It also promoted the use of digital educational content and teacher training in these countries. In addition, Cisco has established a Networking Academy programme that trains students to design, build, and maintain computer networks. A number of Networking Academies have been established in Africa in countries such as Ghana, Mauritius, and Nigeria.163

Working closely with worldwide education communities, Microsoft has developed technology, tools, programmes, and solutions to help address education challenges while improving teaching and learning opportunities. In countries like Ghana, Kenya, and South Africa, Microsoft has promoted low-cost access to software for schools. In addition, Microsoft established its Partners in Learning programme and its related Innovative Teachers Network, which supports teacher development projects in a number of African countries.164

160 http://www.qualcomm.com/citizenship/wireless_reach/projects/education.html#indonesia
162 Cisco supports NEPAD E-Schools demonstration project. Available at: http://www.globalhand.org/en/browse/partnering/6/all/document/20881
3.4.2.5 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.

Millions of non-governmental organizations (NGOs) provide critical health, education, and economic development services in developing countries, and these NGOs are increasingly using advanced mobile devices, including 3G connected e-readers, to deliver such services. This creates a lot of exposure among potential government and business users, as well as consumers. Worldreader, for example, is using Kindle e-readers to deliver books and educational content to elementary and secondary school students in Ghana.

The Fundacion Omar Dengo in Costa Rica works with that country’s Ministry of Public Education to implement a national programme 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 1987.165

Computers for Schools Kenya (CFSK) is modelled after the award-winning Computers for Schools Canada. CFSK distributes PCs in Kenyan schools, working through a partnership of communities, private sector corporations, civil society organizations, and international charities and development partners. CFSK has provided more than 50,000 personal computers in over 3,000 public and primary schools, technical training institutes, teacher training colleges, medical training centres and universities. CFSK also provides a preventive and curative maintenance programme for the computers, and has made available additional equipment such as electricity generators, as well as Internet access.
In addition, CFSK provides training for heads of schools and other administrators, teachers and tutors, and members of school boards and parents/teachers associations. CFSK also has developed digital multimedia teaching and learning resources specifically intended for the national secondary school curriculum, as well as software tools for school management. As a result of this project, an estimated 2 million young Kenyans have access to ICTs.\textsuperscript{166}

IICD is a non-profit foundation that specialises in ICTs as a tool for development. IICD is active in Africa and Latin America in education, governance, livelihoods, health and the environment. At present, IICD is supporting 32 education projects in seven countries, directly affecting more than 300,000 teachers and students and indirectly benefiting 1.3 million others. In Burkina Faso, for example, more than 100 teachers were taught how to build their own websites. They learned how to find new materials on the Internet, and to use video, web publishing and other applications to improve their lessons. A similar project in Bolivia trained teachers to create videos and CD-ROMs to support lessons in mathematics, languages and indigenous Bolivian culture. Its success inspired the Bolivian government to launch a national programme to put computer labs in 1,000 schools.\textsuperscript{167}

Worldreader is a US and European non-profit that gives access to digital books to children in developing countries. The organization donates e-readers with local and international e-books. As of June 2012, the organization had put over 220,000 e-books into the hands of 1,000 children in sub-Saharan Africa. The iREAD project was launched in Ghana in November 2010 as the first pilot study involving the classroom use of e-readers in the developing world. Interestingly, many of the books in the programme are from African publishers and authors. More recently, the organization partnered with two charitable organizations to bring Worldreader programmes to the Ntimigom School in Kilgoris, Kenya, and the HUMBLE School in Mukono, Uganda. The organization is also testing an additional platform that will enable them to extend the impact even further. With the Worldreader Book App for mobile phones, children can now even read digital books on a basic cellular phone.\textsuperscript{168}

\textsuperscript{165} Fundacion Omar Dengo, available at: http://www.fod.ac.cr/?q=principal

\textsuperscript{166} http://www.cfsk.org/

\textsuperscript{167} http://www.iicd.org/our-work/education

\textsuperscript{168} http://www.worldreader.org/what-we-do/
3.4.2.6 Other funding sources

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 that, while 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.¹⁶⁹

¹⁶⁹ 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://virtualcampuses.eu/index.php/Deer_Leap_Programme

3.4.3 Sustainability

Sustainability of ICT initiatives has increasingly been described as the sum of the inter-relations and inter-linkages between the wider policy environment, technology, telecentre operators and managers, capacity building, content and services, networks and partnerships and community. This, too, can be applied in the school connectivity context, particularly where school connectivity is leveraged to benefit the community, as described in the following chapter.

The sustainability concerns of telecentres are centred on the following issues:

- **Financial** – Breaking even, profit-making, etc.
- **Social** – Community acceptance, community development and impact,
• **Organizational** – Administration and management of the telecentre, including capacity-building, infrastructure maintenance, etc.

• **Policy-related** – Whether there is a conducive policy environment related to connectivity, IT infrastructure, etc.  

Albania’s e-schools project has given specific attention to sustainability. Partnerships have played a crucial role in implementing and maintaining sustainability of the project. Although the Ministry of Education and Science (MoES) and local governments are the key partners in the implementation, the MoES has established an inter-ministerial National Task Force and expert sub-committees to manage the project. Expert sub-committees define workplans according to specific tasks and regional needs. 

In accordance with the Prime Minister’s request for UNDP assistance, UNDP has contributed USD 829,373 for the project and has set up the Programme Implementation Unit (PIU) located at MoES. There are also numerous private donors who have contributed to the e-Schools project:

- The Chinese government donated 1,360 computers
- The Albanian Banking Association donated USD 65,000
- Western Union Corporation donated USD 25,000
- Raiffeisen Bank donated USD 45,000
- UFO private university donated 1 computer lab
- ISSETI corporation donated 1 computer lab
- Art Gold project donated 1 computer lab

The Government of Albania also dedicates budgetary resources to the introduction of ICTs in education and to connecting schools to the Internet.

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3.5 Monitoring and evaluation

Monitoring and evaluation are critical components 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) analyse the impact of broadband access on learning.

Countries with the intent 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, e.g. leveraging widespread mobile phone use for m-education.

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.\textsuperscript{173} 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.\textsuperscript{174}

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

<table>
<thead>
<tr>
<th>Date</th>
<th>Primary</th>
<th>Secondary</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of schools</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number of students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number schools with Internet access</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of schools with broadband Internet access</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of students covered by Internet access</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of students covered by broadband Internet access</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 online (Internet-enabled) and m-enabled curricula and tools;
- Level of use of online (Internet-enabled) and m-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, 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 by-products 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: 176

- **Infrastructure**: Identifying ICT/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. 177


### 4 Leveraging Internet school connectivity

In addition to serving educational needs, Internet-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 telecentres

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. As more job applications move online, family members and members of the community without home Internet access need a public Internet access point to apply for jobs.

- **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.\(^{178}\)

The World Links programme drew on its Zimbabwe experience to expand to other countries and to develop a training programme 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 Sao Paulo, Brazil, did not specifically develop telecentres, but instead offered community-oriented technology training in school computer labs during non-school hours.\(^{179}\) Although general PC usage training does not require broadband connectivity, such programmes are enhanced by the ability to provide broadband-enabled services.

In Sri Lanka, schools in the *Computer Learning Centres* (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.\(^{180}\)

In Uganda, a *school-based telecentre* (SBT) Project was launched in 2004 with telecentres based at schools but open to the community, especially during holidays. The project was implemented by SchoolNet Uganda, together with the Uganda Communication Commission (UCC), the Rural Communication Development Fund (RCDF), the participating schools and the Ministry of Education and Sports. One of the main objectives of the project was to explore creative ways of ensuring sustainability of educational institutions’ ICT facilities and activities. For the pilot project in five schools, the partners contributed the following:

- **Uganda Communication Commission (UCC)** – Utilizing the Rural Communication Development Fund, UCC contributed USD 40,000 in the form of VSAT equipment and 10 new computers, along with technical auditing.
- **Ministry of Education and Sports** – School selection, policy support and training, project monitoring and evaluation.
- **SchoolNet Uganda** – Project management and coordination, 50 refurbished computers, technical, pedagogical & telecentre management training and support and mainstreaming the telecentres into SchoolNet activities.
- **The schools** – A dedicated room, burglar proofing, power upgrades, LAN materials, security, paying recurring electricity and Internet bills, teacher training, facilities for a training centre for
the Ministry of Education and Sports, forming a telecentre management committee, opening the centre to the community and leading the overall management of the centre.

- Faith Action Organization Development – Stakeholder mobilization and school-based telecentre management at Ngora High School.¹⁸¹

¹⁷⁸ Bloome, Anthony, “School Networking Initiatives and School-Based Telecentres:

4.2 Connected schools as anchor institutions

Another means of leveraging Internet-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 Internet-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.¹⁸² 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.

Anchor institutions can also be useful in managing the Total Cost of Ownership of school connectivity projects, particularly where connectivity projects also involve the need to provide electricity. The Organización de Estados Iberoamericanos para la Educación, la Ciencia y la Cultura (OEI) aims to provide rural and remote communities with access to communications technologies, but also stresses that electricity is essential to providing the basic conditions required for teaching and for the use of IT and communications technologies. It also aims to convert schools into hubs for community involvement and assembly, allowing the schools’ facilities to be used for cultural activities, literacy campaigns, Internet based training and leisure activities.¹⁸³


**4.3 Reaching disadvantaged populations**

In addition to addressing broader educational and socioeconomic goals, the expansion of Internet 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 Internet 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.\textsuperscript{184} One of the projects focused on the distribution of “talking books” to higher-education students with visual or reading disabilities. 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. Likewise, cloud computing now promises to facilitate delivery of assistive technology, such as screen readers, for blind and low-vision users.

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, Internet 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.

Moreover, regional and national school systems can require the procurement of end-user equipment that is accessible to persons with disabilities, both in community ICT centres and classrooms. This ensures that children and adults with disabilities are able to use the available ICT equipment.\textsuperscript{185}


\textsuperscript{185} See Module 4 of the Connect a School, Connect a Community toolkit for more information on meeting the needs of persons with disabilities in schools and Section 4.4 in particular on procurement issues. http://www.connectaschool.org/itu-module/15/384/en/persons/w/disabilities/connectivity/Section4.4_procurement_policies/
4.3.1 Broadening Teaching Possibilities

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

In Bangladesh, ICTs have been incorporated into the non-formal and continuing education sector. Learning centres such as Gonokendros (Union Libraries) have been established by the non-profit BRAC and Grameen Communications’ Village Computer and Internet project. Although these centres are primarily set up as community centres in rural and under-served areas, the aim is also for them to be access points for informational and educational content, communication services, and other services.

An evaluation of an ICT for education project in Russia, carried out at the end of the 2007/08 school year, found that enrolment in distance learning courses increased by 75 per cent. The enrolment 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.

The common thread linking such initiatives is the Internet 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.


188 World Bank. Implementation completion and results report (ibrd-47260) on a loan in the amount of USD 100 million to the Russian federation for a e-learning support project in support of the first phase of the government's education modernization programme.
5 Cross-Cutting Issues

In the twenty-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 affected by several cross-cutting issues, including: (1) content and curricula for schools, (2) teacher training, (3) assistive technologies and accessible ICTs for persons with disabilities, (4) the availability of low-cost computing devices including mobile phones, (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 Internet connectivity to schools is a first step. Access to an Internet 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. Costa Rica, for example, introduced computers in primary schools in rural and marginal urban areas, along with the Logo programming language and other software tools. This has supported teaching methods and collaborative classroom activities to develop students’ cognitive skills and creativity.\(^{189}\)

There are particular needs for content addressing the interests and needs of, for example, indigenous people, persons with disabilities, and women and girls, among others. These are explored more fully in Modules 3, 4 and 5, respectively, of the Connect a School, Connect a Community Toolkit.

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 or mobile-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 ICT 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 more than 1 billion people living with disabilities around the world. Policymakers need to consider measures to ensure that ICTs are accessible by persons with disabilities. This means, for example, that accessible features related to vision, hearing, mobility or cognition need to be included in mobile handsets. Moreover, websites should be designed to be accessed with screen readers for the blind, and computers should be adapted for people with limited mobility.

In addition, since many persons with disabilities are illiterate, it is essential that basic life skills training be provided as part of Internet initiatives, so that disabled individuals can become independent and fulfilled members of society.

Ideally, funding and planning for accessible ICTs and more specialized equipment, known as 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. For more information on accessible ICTs and assistive technology, please see Module 4 of the Connect a School, Connect a Community toolkit.

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. However, 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. 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.

192 http://www.qualcomm.com/media/releases/2008/12/03/fundacao-portugal-telecom-and-qualcomm-collaborate-benefit-severely
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. 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. Negroponte then founded the One Laptop Per Child (OLPC) association, which manufactures the low-cost XO computer, specifically designed for children in developing countries. XO laptops have been ordered, delivered and/or deployed to 2.4 million children and teachers in 42 countries. The biggest deployment has been in Uruguay, which provided all of its primary school children with a laptop before the end of 2009.

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 Uruguay, Brazil, Honduras, Peru, Haiti and Paraguay. The United States Agency for International Development provides assistance for Afghanistan’s OLPC project, while the Danish government is assisting with funding an OLPC pilot in Nepal.

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. The Classmate is being used for Portugal’s e-school initiative, and Venezuela ordered one million of them in 2009. 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 awarded a tender for 150,000 Indian-manufactured Mobilis laptops as part of its One Computer Per Student programme.
In Thailand, the One Tablet Per Child (OTPC) project officially launched in 2012. The Thai government planned to distribute tablets made in China to all first graders in the academic year of 2012, and to extend the distribution to seventh grade students the following year.²⁰⁵

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.

¹⁹³ 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/
¹⁹⁵ http://one.laptop.org/about/countries
¹⁹⁶ http://www.ceibal.edu.uy/
²⁰⁰ http://www.iadb.org/Projects/project.cfm?id=PR-T1081?=en
²⁰² http://blog.olenepal.org/index.php/archives/182 and
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 behaviour.

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.\(^{206}\)

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.

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.

\(^{206}\) http://www.itu.int/osg/csd/cybersecurity/gca/cop/index.html
5.6 Awareness raising of targeted population and capacity building

One key to realizing the optimal benefits of Internet-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 Internet-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, Portugal and Thailand); 2) bringing together development partners and new technologies (Macedonia); (3) subsidizing Internet access tariffs for schools (United States); (4) Setting up public/private partnerships to achieve connectivity and ICT in education (Antigua and Barbuda); (5) focusing on school connectivity as part of national ICT Policy (Albania and Colombia), including broadband
policy and plans; and (6) making school connectivity part of universal access and service policy and strategy (Ghana).

6.1 Albania

The Government of Albania recognizes that the public education system is critical to Albanian society. It has embarked on a path to prepare students to work and excel in an information-based, technologically advanced society. Within this context, the government initiated the e-School Programme in December 2005, assisted by UNDP. The main goal was to introduce ICT skills to Albanian students in both primary and secondary schools. The programme provided modern computer labs equipped with high-speed, reliable Internet connectivity. It also addressed the needs and capacity of teachers to use ICTs through a number of practical training courses and ICT curricula. The emphasis was on Internet connectivity, bridging the digital divide and raising awareness of ICT needs in schools. 207

Assisted by UNDP, the Albanian government created a working group in late 2005 to draft the Master Plan for the e-School Programme, which was adopted and officially launched by the Albanian Prime Minister on 19 December 2005. During the implementation of the project, a set of ICT educational targets was introduced, including the objectives that all public high schools (376 high schools) and 800 elementary schools be equipped with modern computer labs, along with well-defined standards for hardware, networks and applications. The plan also called for teacher training on ICT basics, the use of computers and productivity applications, basic Internet techniques, and basic computer and network troubleshooting. 208

A new, modern ICT curriculum has also been developed and implemented for elementary and high schools. In parallel, an agreement was signed between Microsoft Corporation and the Albanian government that allows all public schools to install free and subsidized software. 209

The Albanian government has continued to give significant importance to the introduction of ICTs in education. In 2010 and 2011, the education budget emphasized the introduction of ICTs, with allocations estimated at between 3.4 and 3.8 per cent of GDP. ICT was added to the curricula for 17 vocational education and training schools. As of January 2011, dedicated Internet service of 1 Mbps downloads and 256 Kbps uploads per school was available in every school with a headmaster, except
for those in remote towns where five grades (1 through 5) were consolidated into a single class. The government has negotiated with the incumbent service provider, Albtelecom, to offer affordable connectivity in schools. Albtelecom provides school Internet connectivity throughout the country under its contract with the Ministry of Education.  


### 6.2 Antigua and Barbuda

The Connect Antigua and Barbuda Initiative, which was launched by the government in 2006, comprises a number of elements, including promoting computer literacy, bridging the digital divide, and connecting Antigua and Barbuda to the world. Several distinct segments were defined, with the aim of increasing the usage of computerized technology by both students and adults.

Components include the:

- Community Computer Access Centres (CACs)
- Community Technology Officers (CTOs)
- Mobile IT Classrooms
- Technology for Early Childhood Education
- Technology for Institutions for Higher Education
- Technology for Communication, Education & Empowerment
- Technology for Education 20/20
- Multilingual Studies Programme
- Technology for the Physically, Visually and Otherwise Challenged
Within the context of its programme, the government of Antigua and Barbuda has sought partnerships with investors and telecommunications companies to enable the introduction of ICTs in education and, in particular, to allow connectivity and availability of computers in schools and for students.

The Ministry of Information, Broadcasting, Telecommunications, Science and Technology, in collaboration with the telecommunications company LIME, launched the Technology for Education 20/20 initiative in 2011 to change teachers’ perceptions of ICTs and how they should be used, and to encourage teachers to consider connectivity and laptops as a way of increasing student motivation and engagement. The first component in the collaboration between government and LIME is to provide 1,600 private and public primary and secondary school teachers with a modern, high-speed laptop computer and broadband Internet access at their homes. The teachers also will get subsidized Internet service installation at their homes (at a cost of USD 59 plus tax). Additionally, the government is paying the bills for the first four months of Internet access once the service has been installed at their homes. The second component of the initiative is to fully Wi-Fi enable all secondary schools across Antigua and Barbuda.212

In addition, in July 2012, the government launched its Government-Assisted Technology Endeavour (GATE) as a partnership with regional telecom firm Digicel to improve Antigua’s broadband Internet connectivity and stimulate growth in innovation, entrepreneurship, job creation and sustainability. GATE has four major components:

(1) An ICT Cadet Programme, which was launched in June 2012, aimed at targeting individuals who have completed secondary school for training and work experience in ICT;

(2) A component aimed at improving internet connectivity and technology in the classroom, including providing secondary school students with a 4G LTE computer tablet and 4G LTE broadband connectivity;

(3) A component aimed at providing 4G LTE connectivity for Antigua’s government; and

(4) A component aimed at creating a multi-purpose ICT training facility and special needs resource centre in the Michael’s Mount area of Antigua. 213

During the launch of the project, the Minister of IT, Dr. Edmond Mansoor, said that Digicel had donated USD 6.75 million towards the tablet fund, in which 6,000 tablets will initially be purchased. 214
6.3 Chile

The government of Chile established the Enlaces programme to provide subsidized Internet access to the nation’s schools. It is administered by the Centre for Education and Technology within the Ministry of Education.215

Enlaces began work in primary and secondary schools in urban areas, but it expanded in 2000 to incorporate rural, less-accessible schools. From its inception in 1992, the programme has focused on government primary and secondary schools. Enlaces provides access to the Internet to approximately 75 per cent of students in schools that are enrolled in the project, 67 per cent of which have a broadband connection.216

In 2002, a new programme called Red Enlaces Abierta a la Comunidad was implemented to provide communities with access to the Internet through 2,000 educational facilities and computer labs.217

Enlaces has used a variety of financing sources and mechanisms to achieve its connectivity goals for Chile. In 1998, for example, the Ministry of Education reached an agreement for the Chilean telecommunication operator Compania de Telecomunicaciones de Chile (CTC) to provide free, unlimited Internet service to all schools in the country for a period of 10 years. Since 2004, as part of its efforts to promote broadband connectivity, Enlaces has reached agreements with multiple operators provide preferential fees to educational facilities. Enlaces also established a fund through which schools could apply for a subsidy equal to 50-100 per cent of the broadband connection fee.218

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 per cent of these have access to broadband. In 2008, 2,644 schools were granted funds for broadband Internet connectivity.

Chile’s Technologies for a Quality Education Plan, announced in 2007, foresaw an additional USD 200 million being spent on school infrastructure, including connectivity and computers, through 2010.

In 2011, the Minister of Transport and Telecommunications, Pedro Pablo Errazuriz, and the Minister of Education, Joaquin Lavin, announced a commitment to have all educational establishments connected to broadband networks by March 2012, including schools in rural or more remote areas (which would be connected via satellite). By 2011, Chile had reached a level of 10 children per computer. The programme was enhanced with an investment of USD 7 billion in 2011 and a similar public investment in 2012, through the Global Telecommunication Development Fund. The aim was to increase the number of connected schools, which at that time amounted to 5,600 schools. The 2011 Plan aimed to raise the standards of these schools, and to connect the remaining schools without connectivity, thus reaching a universe of more than 11,600 establishments.


216 The Enlaces programme only applies to subsidized municipal schools. See http://www.chile-usa.org/education.html


### 6.4 Colombia

In Colombia, the **Computadores para Educar** programme is reducing social divides and improving educational quality in the country by incorporating ICTs into basic and intermediate public education.

This social programme, set up by the Ministry of Information and Communication Technologies and the Ministry of Education, was evaluated in a study conducted by Universidad de los Andes in 2010. The results were clear that ICTs have a positive impact on educational quality and academic achievement. Provided that teachers are properly trained, students are more likely to move ahead to
higher education, and social disparities will be reduced. The Ministry of Information and Communication Technologies’ Plan Vive Digital for the expansion of broadband technology is now taking up the challenge of increasing the reach and magnitude of Computadores para Educar.

The Computadores para Educar programme has found ways to adjust its management model in the field, not only to make the programme more efficient and to improve the cost–benefit ratio, but also to make it more inclusive and sustainable for the community.

From 2000 to 2010, Computadores para Educar provided 291,261 computers to 20,673 public schools (more than 53 per cent of all schools in Colombia), offering ICT access to almost 6 million children (65 per cent of children enrolled in the public system). Educational training was provided in 11,135 schools, enhancing the competence of 43,986 teachers (15 per cent of the total number of teachers in the country). A total of 78,327 computers were reconditioned, avoiding the disposal of more than 4,000 tons of electronic waste. The total social investment made by Computadores para Educar to groups in need in Colombia has amounted to some USD 172 million over 10 years. This investment has generated a social return of 2.4 times that amount. 220

In 2012, the Ministry of Information and Communication Technology further implemented the integration of computer delivery to schools with the training of 28,000 teachers in schools countrywide. A team of 2,300 ICT managers, who were linked with universities and schools, won a public tender to supply computers in every education centre and provide training to teachers in ICT skills, in order to improve classroom practices. "The coverage of this strategy covers all over the country, reaching more than 28,000 official educational centres, located in 1,123 municipalities," said ICT Minister Diego Molano Vega in an interview in August 2012. He noted that the strategy will be implemented in the next three years, during which 400,000 terminals will be delivered, benefiting mainly the sectors of the population with the highest degree of vulnerability. 221


6.5 Ghana

The Ghana School Connectivity Project is an example of a well-defined process where stakeholders are working together to achieve the goal of providing educational institutions with high-speed computers, printers, scanners, projectors and servers and linking them with internet access.

The project is coordinated by the Ghana Investment Fund for Electronic Communications (GIFEC), which was established in 2004 and provides support to the Ministries of Education and Local Government by deploying facilities in educational institutions in unserved and underserved areas. The GIFEC was established in 2004 as an implementing agency of the Ministry of Communications to facilitate the spread of ICT use in rural Ghana. Its goals are to promote research and reading culture, to train rural schoolchildren and teachers in the use of ICTs, and to empower rural communities by providing access to information, so that direct participation will be increased in development and decision-making processes.222

The scope of the School Connectivity project was expanded to include other training and vocational institutions during the period 2010-2012. By 2012, GIFEC had supported 263 educational and training institutions, as follows:

- 10 youth leadership training institutions
- 37 NVTI centres
- 26 technical institutions
- 114 senior high schools.
- 43 nursing/midwifery training colleges
- Eight agricultural colleges
- 25 community development colleges223

ICT centres for all colleges of education have been inaugurated throughout the country. The facilities are aimed at making all teacher-trainees ICT-proficient, in order to support ICT education, which is now an examinable subject in all basic schools. The cost of connecting these centres, which is provided under the National School Connectivity Project, is USD 45,000 for each college, so as to ensure that the centres are equipped with computers, a projector, an Uninterrupted Power System (UPS), printers, scanners and Internet connections. 224
6.6 Ireland

In 2004, Ireland’s government decided that to grow and sustain a knowledge-based workforce, it must ensure that every school in the country was technologically proficient, beginning with universal access to broadband connectivity. To achieve this, the Irish government teamed with the industry body representing telecom and Internet companies to jointly fund an EUR 18 million national broadband network for Ireland’s schools. The network would integrate terrestrial and satellite communications and be centrally managed by HEAnet, Ireland’s national education and research network.\(^{225}\)

The Next Generation Broadband Policy Paper of June 2009 stated that “connectivity to schools, in particular, will benefit from the Government’s investment in broadband infrastructure. We aim to equip second-level schools in Ireland with 100 Mbps of broadband connectivity and Local Area Networks (LAN) on a phased basis. This will enable students to learn and collaborate online.”\(^{1226}\)

The provision of 100 Mbps broadband Internet access to all second level schools was seen as contributing to an important policy objective of the government which was to promote a learning environment in schools that:

- Takes full advantage of ICTs in teaching and learning and in the delivery of a modern curriculum, and
- Encourages all students to become self-assured, self-directed learners throughout their lives, and to acquire the aptitudes, values and skills for successful participation as citizens of the knowledge society.\(^{227}\)

The Irish government appointed HEAnet\(^{228}\) to leverage public investment while also allowing synergies and operational efficiencies to be explored with regard to HEAnet’s current operation of the Schools Broadband Network, which continues to deliver broadband connectivity to the roughly 4,000 schools...
across Ireland. The initial contract(s) under this programme call for delivering 100 Mbps symmetrical broadband connectivity to 78 post-primary school locations within the scope of a pilot project. The 78 school locations represent a mix of schools in urban and rural areas and have been agreed by the Programme Steering Committee, with the objective of delivering specific learning objectives. In addition, schools will receive an edge router managed by HEAnet, and access to the Internet will continue to be filtered (as is the policy under the current wider Schools Broadband Programme). Wireless LAN and ICT equipment (laptops and projectors) will be delivered to each of the 78 schools in the initial pilot phase.229

All second-level schools are due to have the 100 Mbps broadband service installed by the end of 2014. Some 200 were to receive it in 2012, 200 in 2013 and the final 250 schools in 2014. The provision of service to the schools to be connected in 2012 was to be awarded in a tender competition under an established framework agreement administered by HEAnet.

This project is the result of cooperation between the Department of Communications, Energy and Natural Resources and the Department of Education and Skills, the Higher Education Authority, HEAnet and the National Centre for Technology in Education, in conjunction with core services supplied by ESB Telecom. The Project has been co-funded by the European Regional Development Fund (ERDF).

HEAnet has built and will maintain the network on behalf of the Department of Communications, Energy and Natural Resources. The National Centre for Technology in Education is charged with the integration of ICT within schools. They will also provide front-line support for the staff of the schools. ESB Telecoms has provided backhaul from regional locations to Dublin.

In 2012, 202 school connections were connected, meaning that 280 of Ireland's post-primary schools will be in a position to benefit from a 100 Mbps broadband connection from October 2012. Remaining post-primary schools will be connected over 2013 and 2014 as per the Government's national roll-out plan.230

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225 http://www.idirect.net/~media/Files/Case%20Studies/CASE%20STUDY_Ireland_Education.ashx
227 http://www.dcenr.gov.ie/Communications/Communications+Development/Schools+Broadband+Access+Programme/

CONNECT A SCHOOL, CONNECT A COMMUNITY connectaschool.org
HEAnet is Ireland’s National Education and Research Network, established in 1984 by the Irish Universities with the support of the Higher Education Authority. HEAnet provides an essential e-Infrastructure service across all levels of the Irish education system. The very high bandwidth network connects all Irish Universities, all Institutes of Technology, other higher education institutions (HEIs) and research organizations, in addition to all primary and post-primary schools across Ireland.

http://www.heanet.ie/news_and_publications/schools_100mbps_broadband

http://www.heanet.ie/news_and_publications/100mb_rollout

6.7 India

Digital learning solutions are making significant inroads into India. The government of the state of Punjab recently announced the development of 795 new computer labs in government schools across the state as part of Phase V and VI of a centrally sponsored ICT scheme in Punjab. During the first four phases, the government focused on enhancing ICT education in schools through new classes and curriculum and training teachers in effective use of ICT tools in teaching. ICT-enabled schools in Punjab have also been given access to power generators and broadband Internet connections to facilitate implementation of state-wide school management of information systems (MISs) and geographic information systems (GISs), which are under development.

Similarly, the government of the Indian state of Himachal Pradesh has awarded a contract to implement next-generation solutions for teaching and learning in 1,471 schools across 12 districts in the state. The project is worth INR 1.57 billion (USD 29.62 million), and will provide computer-aided learning solutions to schools across Himachal Pradesh. The schools involved in the project will acquire digital classrooms equipped with interactive white boards and multimedia content. The project will help 618 government senior secondary schools, 848 government high schools and five “smart schools” in the state. In addition, 7,500 teachers will receive training to understand and use these technology solutions and to facilitate ICT education of their students.231

6.8 Jordan

The Government of Jordan has made significant efforts to integrate ICTs into education, including by ensuring connectivity in schools. E-learning programmes like the Jordan Education Initiative and EduWave have made a strong contribution to Jordan's ICT growth and to its future as an integral part of a global knowledge economy. Jordanian law now requires all public schools to offer English from the first grade onward and to teach computer usage from the second grade through high school. All secondary schools in Jordan now have fully equipped computer labs, and ADSL connectivity has reached more than 600 of Jordan's 3,000 public schools. The number of students per computer ratio now stands at 51 to 1, compared to 120 to 1 in 1999. 232

The Ministry of Education (MoE) has implemented a number of projects, including the introduction of ICTs through computer labs in public schools, as well as Internet connectivity, and the provision of equipment such as printers and, scanners. The MoE also created an e-learning portal (EduWave), which enables all end users to communicate through discussion forums, chat applications, e-exams, e-mail and others. EduWave also enhances education by activating the various e-content subjects, such as math, science, English and Arabic languages, IT, civics and health education. The MoE also integrated ICTs into the education syllabus in 2000 for grades 7-11 and provided training to teachers, encouraging them to attend professional development programmes. MoE also presented scholarships to some teachers so they could get an ICT diploma or a master's degree in education. 233

In addition, the Jordan Education Initiative was created in June 2003 as a partnership between the public and private sectors, by the World Economic Forum and the Jordanian Government. The aim was to support Jordan's efforts to improve the level of education, encourage creativity, develop capabilities and build a knowledge economy, using the latest technological tools in 100 government schools that were later named "Discovery Schools." 234

Apart from ensuring a competitive marketplace where connectivity is becoming widespread throughout the country, the Ministry of Information and Communication Technology (MoICT) has begun the National Broadband Network Programme (NBN Programme), which further contributes to the development of Jordan’s educational system by increasing ICT diffusion in universities, community colleges, schools and other learning institutions throughout the kingdom. 235
Concrete results of the NBN Programme include the University Broadband Network (UBN) and the Schools Broadband Network (SBN). The UBN has included the construction of a broadband network connecting all eight public universities, as well as the Jordan University of Aqaba and the Ministry of Education. The network is connected through a consolidated Internet gateway and is linked to the European educational network GEANT- Eumedconnect. The legal framework permitted the use of dark fibre cables from the National Electric Power Company (Nepco) as a backbone for this network. The universities were thus connected through fibre cables and equipment in a collaborative effort of the MoICT and Nepco. The government also signed an indefeasible right of use agreement with JUNET and Nepco.\textsuperscript{236}

Meanwhile, 227 schools in Amman were connected to the Schools Broadband Network, along with 56 schools in Aqaba (under the Aqaba Special Economic Zone Authority (ASEZA) and 363 schools in northern Jordan. Additionally, four schools in the Al-Azraq area were also connected using wireless equipment.\textsuperscript{237}

\textsuperscript{235}http://www.moict.gov.jo/en-us/moict/aboutmoict.aspx

\section*{6.9 Macedonia}

Macedonia, a landlocked, mountainous Balkan nation, might hold the record for the quickest deployment of broadband Internet connectivity to public primary and secondary schools.

The \textit{Macedonia Connects} project was established in 2004 as a partnership between the Macedonian education ministry and the U.S. Agency for International Development (USAID), 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.
The project to implement Internet connectivity in all 360 primary and 100 secondary schools had its roots in a 2002 donation of 5,000 computers by China. It was decided that providing Internet access would enhance the potential of the computers.\textsuperscript{238} At the time, only a few of Macedonia’s urban secondary schools had broadband access. Broadband was not available to rural schools, and dial-up Internet access was too expensive.

Macedonia Connects was a partnership between the Ministry of Education and Science (MoES), USAID, and a local ISP called on.net. The project was administered by the Academy for Educational Development (AED).

On.net was tasked with the job of connecting all schools between May and September 2005. The summer deployment was scheduled in order for the links to be operational at the start of the 2005-2006 school year. On 15 August 2005, the wireless backbone was completed, and on 14 September 2005, a 310 megabit-per-second (Mbps) international Internet connection was launched. All schools were connected before the end of September 2005.\textsuperscript{239}

\textsuperscript{237} AED, mk connects: Macedonia Links Education and Connectivity (2009).

\textbf{6.10 Morocco}

Since the 1990’s, the Moroccan government has realized the key role played by ICTs in enhancing education and enabling a Digital Society. Article 10 of the National Charter of Education and Training of 1999 introduced the concept of the integration of ICTs into education by supporting the acquisition of computing facilities at schools, along with the promotion of distance education and learning.\textsuperscript{240}

The first "e-Morocco" ("e-Maroc" in French) strategy was launched in 2001, enabling the government to increase the use of ICTs in all aspects of life. The subsequent liberalization and privatization policy in the telecommunications sector led to reduced telecommunications costs, resulting in a rising number of
cyber cafés and more access to computers and the Internet, even in small towns. In 2005, the focus of the new ‘e-Morocco 2010’ strategy included reducing digital costs and positioning the kingdom internationally in the ICT arena. Since then, several programmes and initiatives have been implemented.

Following the initial e-Maroc plan, the education axis of the E-Morocco 2010 Strategy, adopted in 2005, aimed to acquire and develop expertise in ICTs. This strategic priority resulted in the launch of the ‘GENIE’ Programme (an acronym of “Generalization of Information Technologies and Communication in Education”), which was supported by USAID with a total budget of approximately USD 11 million.

The aim of the GENIE programme was to enhance the availability of computer labs with Internet connectivity in public schools. The project was built around three complementary axes: (1) acquiring ICT equipment, (2) training of teachers and school administrators, and (3) curriculum development. The prime objective of GENIE was to enable primary, secondary and high schools to benefit from multimedia computer facilities and Internet access, with the aim of improving the quality of teaching.

Along the first axis (equipment), more than 8,600 primary and high schools were scheduled to receive more than 100,000 Internet-enabled computers, plus additional peripheral equipment such as printers and scanners. The teacher training axis included offering basic ICT training to 230,000 educators in the 16 regional computer labs set up for this purpose across Morocco. The curriculum development axis included installing a national laboratory for the development of educational content and setting up a national educational portal. The portal aimed to offer several services such as educational resources, discussion forums, email addresses for all teachers, a virtual library, and educational search engines.

Initially scheduled to conclude in 2009, the GENIE programme was extended for a further four years under Digital Morocco 2013. An additional 9,260 institutions were scheduled to receive multimedia resources and Internet-enabled computers, while 200,000 teachers will benefit from ICT training, and digital content will be further developed. In addition to GENIE, Digital Morocco 2013 also includes provisions to subsidize computer equipment, laptops and Internet access for teaching staff and engineering students.

GENIE has been integrated into national strategies, becoming one of the pillars of "Numeric Morocco 2013," an initiative that aims to make ICTs a vector of human development and a source of productivity.
and added value for the economy and public administration. Ultimately, the kingdom wants to position Morocco as a regional technology hub.\textsuperscript{246}

In 2012, the implementation of the Plan Numeric Morocco 2013 enabled the connection of 150,000 teachers and 90,000 students to the Internet. Initially endowed with a budget of 5.2 billion dirhams, the programme has four strategic priorities: (1) social transformation through information technology (IT); (2) orientating public services towards users; (3) computerizing small and medium-sized enterprises (SMEs); and (4) developing the national IT industry. Under the Plan, a project known as \textit{Injaz was defined as a way for students to acquire a computer and a USB 3G dongle at a subsidized price}\textsuperscript{247}

\textsuperscript{240} ICT in Education in Morocco. Available at: www.infodev.org/en/Document.418.pdf
\textsuperscript{241} Global Resource and Information Directory: Morocco. Available at: http://www.fosigrid.org/africa/morocco
\textsuperscript{242} http://www.ernwaca.org/panaf/spip.php?article1215
\textsuperscript{243} http://www.ernwaca.org/panaf/spip.php?article1215
\textsuperscript{244} Adapted from http://www.anrt.ma/missions/genie/presentation-du-programme-genie and http://www.fosigrid.org/africa/morocco
\textsuperscript{246} http://www.northafricaunited.com/Numeric-Morocco-2013_a1843.html
\textsuperscript{247} http://www.northafricaunited.com/Numeric-Morocco-2013_a1843.html

6.11 Portugal

In Portugal, the modernization of the educational system has been a priority since 1986, and the introduction of ICTs in education has increasingly been seen as an essential element of that modernization. In 2007, the government defined a comprehensive national ICT plan for education, the \textit{Plano Tecnológico de Educação} (PTE). This Plan was carefully defined, taking into consideration the EU’s Lisbon Strategy, ICT policy and regulation, and Portugal’s Strategic National Plan.
The *e.escola* (e.school) Programme was launched the same year (2007) in order to encourage access to the information society and to promote “e-inclusion” through easier access to portable computers and broadband Internet connections. The goals included providing ICT access under favourable financial terms, for all students from the 5th grade of primary school (10-year-old students) through the last year of secondary school.

The *e-escolinha* programme was also introduced, as another initiative of the *e.escola* Programme, to enable students enrolled in the first four years of primary school to benefit from the use of computers and broadband Internet access. The *e-escolinha* programme provided that all children from six to 10 years old – about 500,000 students – could obtain a portable computer for EUR 50, EUR 20, or even for free, depending on the level of social support in their school.  

In order to ensure the financing of the programme, the Portuguese government utilized resources that had been set aside for the development of the ICT sector. In 2001 and 2002, several companies purchased 3G mobile licences through a spectrum auction that raised EUR 460 million. With the long-term goals of the PTE in mind, Portugal’s government set aside the auction proceeds to fund the nation’s ICT programmes, including the educational technology programmes.

The funds have been used to support many programme elements, including subsidized technology purchases for students and teachers. At the same time, the state developed several partnerships with software and hardware manufacturers to give users access to the latest technology at reasonable prices. As the programme matured however, the Ministry of Education assumed full responsibility for all aspects of *e-escolinha*, including the financing. The programme is now supported through government funding rather than offset agreements with telecommunication companies.

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**6.12 Thailand**

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. While all of Thailand’s universities were
connected to the Internet fairly early on, it has taken longer for its roughly 33,000 primary and secondary schools to achieve a similar result.

The effort in schools began with SchoolNet, which benefited from low Internet access rates set by the Telephone Organisation of Thailand (TOT). The process of connecting schools dates back to 1995, when the Thai Social/Scientific, Academic and Research Network (ThaiSARN) was extended to cover about 50 secondary schools in Bangkok as part of the SchoolNet project.\footnote{Minges, Michael, Tim Kelly, and Vanessa Gray, Bits and Bahts: Thailand Internet Case Study. (Geneva, Switzerland: International Telecommunication Union, 2002).}

A turning point for SchoolNet came in February 1998, when TOT began pricing Internet access at the same rate as a local call. The project became known as SchoolNet@1509, referring to the four-digit dial-up code for nationwide Internet access.\footnote{For technical details about the SchoolNet network see Paisal Kiattananan, et. al. “Network Design and Resource Management Scheme in SchoolNet Thailand Project.” In Proceedings of the 1999 Internet Society Conference. http://www.isoc.org/inet99/proceedings/2e/2e_1.htm and http://satjournal.tcom.ohiou.edu/issue12/uppalakom.html}

The Communication Authority of Thailand (CAT) also supported the project by providing international Internet bandwidth. Between 1998 and 2003, the SchoolNet project connected some 4,800 schools to the Internet.

In 2003, the SchoolNet project was turned over to the Ministry of Education, where it was merged into a new educational network dubbed EdNet. In addition to public schools, EdNet includes universities in order to optimize network utilization and other resources.

The Ministry developed a National ICT for Education Master Plan (2004-2006). One goal was to increase telecommunication services in schools. Although most schools had electricity, 70 per cent of primary and 17 per cent of secondary schools had no telephone lines. By the end of the Master Plan period, all schools had a telephone line.

\footnote{Minges, Michael, Tim Kelly, and Vanessa Gray, Bits and Bahts: Thailand Internet Case Study. (Geneva, Switzerland: International Telecommunication Union, 2002).}

6.13 United States

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.

The E-Rate programme, officially known as Universal Service Schools and Libraries Discount Mechanism, was created as a part of the Telecommunications Act of 1996. The Act revised the universal service support system in the United States. One new provision was the inclusion of affordable telecommunication service to primary and secondary schools. The Act specifically created an additional new (the fourth) Universal Service Fund programme to help schools and libraries connect to the Internet. The programme’s policies and rules were designed to promote competition between service providers and to give applicants (that is, the schools and libraries) the most cost-effective means to connect to the Internet. The E-Rate programme is funded with USD 2.25 billion dollars annually from the Universal Service Fund. This programme is supported by assessments on telecommunications companies, not the federal budget.

The E-Rate Programme functions by providing discounts to educational institutions for their telecommunications and Internet access service bills. The subsidized amount is reimbursed by the federal Universal Service Fund (USF), to which all operators contribute. Under the supervision of the Federal Communications Commission (FCC), a specialized company known as the Universal Service Administrative Company (USAC) administers the programme.

To be eligible to receive discounts, a school or library must meet certain eligibility criteria. In general, elementary and secondary schools -- including many private and religious schools -- are eligible to receive discounts. Public libraries and library systems also can receive E-rate discounts, provided they meet the eligibility requirements set for them.

Eligible schools request the E-Rate discounts for four service categories: telecommunication services, Internet access, internal connections, and basic maintenance of internal connections. The discounts range from 20 per cent to 90 per cent, based on the level of poverty and the location (urban or rural) of the students. Schools applying for the E-Rate discount must:
1. Submit a plan that shows how technology will be used to improve curriculum or library services, as well as how E-Rate funds and other financial resources will be used;

2. Submit a description of services requested (which is put online to notify service providers about the products and services being requested);

3. Select a service provider from the bids submitted;

4. Submit a certification form to request funding.

The E-Rate programme disbursed more than USD 16 billion in funding to schools nationwide between 1998 and 2008. The E-Rate has been instrumental in boosting Internet access and broadband connectivity in U.S. public schools. E-rate funding requests for Priority 1 services (telecommunications and Internet access) have risen steadily over the past five years, from USD 1.8 billion in 2008 to USD 2.4 billion in 2012.

Seeking to respond to technology trends, the FCC recently has adopted a new E-Rate policy to help bring affordable, super-fast fibre connections to America's schools and libraries. It allows participants to use E-Rate funds to connect to the Internet in the most cost-effective way possible, including via unused fibre lines already in place across the country or through existing state, regional and local networks. With these fibre networks, schools and libraries can provide students and communities with cutting-edge connectivity, while saving millions of dollars.

The FCC is also launching "School Spots," a programme that allows schools to provide Internet access to the local community after students go home. With affordable fibre links, these School Spots are a major step toward the National Broadband Plan's goal of connecting an anchor institution in every community to affordable 1 gigabit-per-second broadband service.

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252 ERate Funding Proces Website. Available at: http://fundsforlearning.com/index.php


6.14 Uruguay

President Tabaré Vázquez announced the Ceibal Project in December 2006 with the aim of providing each child in primary school with a laptop by 2009. Some USD 21 million was allocated to the project in 2007 -- the equivalent of 2.7 per cent of the entire education budget. The project was implemented in four phases, starting with a pilot project in a school in the town of Villa Cardal, in the department of Florida, using 200 computers donated by OLPC. The pilot was followed by the scaling up of the project to provide laptops to schools in all of Florida Department, then in 2008 to all schools in all departments of the country, except the capital Montevideo. The final phase extended the laptops to Montevideo. In four years, Plan Ceibal delivered 450,000 laptops to all students and teachers in the primary education system, along with free Internet access throughout the country.\footnote{adapted from Uruguay Case Study, http://www.ceibal.edu.uy/Paginas/Inicio.aspx, and http://blogs.worldbank.org/edutech/videos/uruguays-plan-ceibal-the-worlds-most-ambitious-roll-out-of-educational-technologies} In 2009, the programme also targeted secondary education, as well.\footnote{http://blogs.worldbank.org/edutech/videos/uruguays-plan-ceibal-the-worlds-most-ambitious-roll-out-of-educational-technologies}

6.15 Zambia

Zambia is a country that, like many developing countries, faces significant challenges in terms of education. There are 8,000 primary schools and only 500 secondary schools in Zambia. The majority of primary schools are located in under-resourced rural areas. There are 2.8 million pupils in primary school and 340,000 in grades 8-9, with 220,000 in grades 10-12. Schooling concludes after grade 12. There are only 71,000 teachers for a total of 3.4 million students, which is a ratio of 100 students for each teacher.
The *iSchool Project*, which is an initiative of AfriConnect Development in collaboration with the Ministry of Education, aims to provide Internet connectivity and online education resources ("e-learning") to Zambian schools on a commercial basis. The goal is to take advantage of the rapid spread of Internet technology in Zambia. Broadband Internet can now bring modern e-learning to an isolated school – no matter its circumstances. Once e-learning material has been created, it can be used by any number of students anywhere. It works with a teacher present, or without; in a well-resourced school or one with very few resources. There is almost no extra cost for each extra child that is taught. In addition, a key objective of working with the Ministry of Education is to develop the same learning materials for all students throughout the country. It will be high-quality, material, mapped to the Zambian national curriculum and tailored to the students' needs -- no matter where they are or what resources they have available.

Within this context, iSchool is aiming to define both technology and infrastructure, as well as content and training. The project will:

- Provide computers (modern desktops and netbooks) and Internet connectivity, along with technical training and support.
- Provide electric power systems where needed.
- Deploy a “computer lab in a container” in some rural locations. This will also allow the use of "remote teaching" from the capital.
- Provide schools with their own websites, and establish twinning schemes.
- Develop new multimedia e-learning content that is interactive, innovative, differentiated, contextualised to Zambia and mapped to the national curriculum. This content is mapped to a half-termly overview that will cover all areas of the national curriculum for each subject and each grade. It also contains weekly plans and detailed lesson plans for each lesson.
- Work with private partners to develop content – for example, the project envisages working with the *Intel Skoool Programme* on maths and science content and with Cambridge University and the University of Zambia to train teachers to develop and use their own open educational resources.\(^{259}\)

\(^{259}\) [http://www.ischool.zm/education.html](http://www.ischool.zm/education.html)
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 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, government education budgets, 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 in a cost-effective manner. Regulatory and other measures can be taken to lower the cost of Internet access to make school connectivity more affordable. This can be achieved in a variety of ways, including through licensing requirements to provide free or reduced-cost Internet access to schools, allocating spectrum at no cost to schools for wireless Internet connectivity, or leveraging access to NRENs or fibre backbones. Low-cost computing devices, mobile phones, applications and content stored on common servers or in the cloud, as appropriate, can be used to reduce the cost of end-user equipment, applications and content.

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

• 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 strategies and agendas.

• A specific "ICT for Education" plan is also desirable, as it ensures that proper focus and detail is devoted to determining how to best use school connectivity in programmes aimed at integrating ICT into education. It also helps ensure that implementation targets are feasible and fundable. A detailed ICT for Education Strategy is also essential to facilitate funding from development partners.

• Key parameters to guide and implement connectivity goals and targets should be determined early in the plan’s development process.

• 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.

• 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.

• 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.

• 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.
• Countries reviewing their UASF legislation may wish to make it more flexible, in order to allow the fund to cover costs for school connectivity and end user equipment where they do not already do so.

• Subsidized Internet access can be a tool to meet universal access goals, with Internet-connected schools serving as the enabling connection points. Such funds could be established cooperatively between school connectivity programmes and network operators or groups funding Research and Education Networks.

• 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 and reducing or waiving spectrum fees of operators in exchange for enforceable commitments to provide free Internet access to schools
  ◦ Unlicensed spectrum – Consider allowing use of unlicensed spectrum for broadband connectivity, reducing network deployment costs compared with licensed wireless broadband options

• Modification of licence obligations – Telecommunication network operator licences can include specific conditions or requirements for the education sector, and regulatory authorities can consider modification of licence 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. Internet-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.

ANNEX 2 – Annotated Outline of a Model National School Connectivity Plan (NSCP)

It is critical to note that the NSCP is an education sector plan for which connectivity to ICT is an
enabler. This informs the proposed approach, the roles and the funding model proposed.

ANNEX 2.1 Introduction to Plan

The National School Connectivity Plan (“NSCP” or “the Plan”) needs to consider existing institutional
frameworks, as well as existing policies, legislation and regulations that may have an impact on the
implementation of the NSCP.

The Plan shall consider best practice approaches, as well as specific characteristics of the relevant
administrative, legal and regulatory frameworks, to make proposals. This should lead to a pragmatic
approach to connect schools to the Internet, and as far as possible, to broadband networks, by a
determined date.

Although tertiary institutions may be considered, the Plan generally addresses connectivity in primary
and secondary schools.

State the Key Challenges Posed by the Specific Realities of the Country

Infrastructure and connectivity – The main concern is with regard to ICT infrastructure and
connectivity, and in particular “last mile” access for schools. This concern is particularly relevant in rural
areas, but it can also be pertinent in certain parts of urban areas where computers and connectivity are
not available.
Existence of a Single ICT4E strategy and coordination – Are there opportunities to combine or associate projects? Is there duplication, lack of experience in sharing or a potential ineffective use of resources and opportunities?

ICT skills – There should be adequate ICT training across the entire education sector. Distance learning should be implemented, particularly in rural areas where infrastructure is lacking.

Content – Is there sufficient local content, including content that is relevant to people in rural areas?

Legal and Regulatory Framework – This needs to be flexible enough to allow specific accommodation of school connectivity – for example, through lower spectrum fees, or by allowing school networks to access spectrum or connect to government fibre backbones at a lower cost.

Cost, Financial Constraints and Sustainability – Costs need to be addressed, and education and ICT sector budgets need to be carefully allocated and managed to ensure the efficient deployment of ICTs. School connectivity does not come cheap, and it is important to define total cost of ownership, as well as mechanisms to ensure sustainability of projects.

Promotion and Awareness - Policy-makers, school administrators, parents and students need to be acquainted with the multi-faceted opportunities, challenges and constraints of integrating ICTs into education.

Monitoring and Evaluation – Core indicators, which measure the inputs and outcomes of a programme or project, are essential in evaluating school connectivity initiatives. In order to measure the true use of resources, actual consumption and cost of the resources must be taken into consideration (e.g., the number of connections, equipment, etc.). The policy objectives -- such as better grades, and less drop-outs, for example -- must also be considered. These outcomes are usually brought about by a series of direct and measurable outputs, such as the number of students, and the number of teachers trained, among others.

Define the Vision and Objectives of the Plan

A representative vision statement might be as follows:
Vision: the provision of affordable high speed Internet access to primary and secondary schools and educational practitioners throughout the country, using any available and efficient technologies, with a preference for broadband through:

- The coordination of stakeholder input and activities to avoid duplication and enhance efficiency;
- The development of a policy and strategy to support, among other goals, the provision of broadband to schools;
- The promotion of the harmonization of activities, approaches, projects and standards in the uses of ICT in education;
- The inclusion of ICT in the curriculum at primary and secondary school level to ensure the provision of ICT skills to students and educational practitioners;
- The development of a schools network that connects schools to each other and provides a portal accessible by students, teachers and parents, allowing centralized information management and reducing the costs of access to that information;
- The promotion of digital inclusion through the development of local content for primary and secondary school education; and
- The promotion of harmonized activities and approaches to funding ICTs in education

Define Specific Actions To Achieve These Objectives:

For example: The achievement of the NSCP targets will be facilitated through a few key policy, legislative and regulatory interventions, including:

- Establishment of an NSCP Project Committee composed of key stakeholders;
- Integration of school connectivity into the universal service plans and financing mechanisms focused on ICT connectivity and integrated with other key infrastructure;
- Integration of school connectivity in any future national broadband plan;
In general, the NSCP will seek to connect schools to broadband networks as a first choice, and other Internet access where broadband is not available. In addition, the NSCP should also consider alternative solutions such as m-learning or the use of e-readers to promote the introduction of ICTs in education.

The NSCP shall bear in mind the country’s infrastructure challenges, but shall also appreciate the opportunities presented by a liberalized ICT sector, where this is the case. The NSCP shall take a technology-neutral approach.

The financing of school connectivity is a key challenge in many countries. Matching the targets and objectives of a school connectivity plan and aligning them with a realistic budget that is fundable is central to the sustainability of any NSCP. It is, therefore, proposed that school connectivity be financed through a combination of government, agency, private-sector and donor funding. Schools will also
need to apply for and provide a level of funding either independently, through the school organization, or through the local school authority.

Targets shall be based on an analysis of the local ICT market, the demand for ICTs in the education sector and other factors, including pricing, policy, and availability of products and services. Targets may include:

• In the short/medium/long term:
  - Determining which schools are to have some form of ICTs in education integration, and in which areas those schools will be located;
  - Determining the number and types of schools that will have Internet access, computer labs or mobile computer labs.

Assumptions may have been made and actions foreseen which are required to calculate and estimate costs for the different phases. These may include:

1. Availability of fixed, wireless and VSAT networks in urban, rural, un-served and under-served areas;

2. Types of equipment to be allotted to each installation – for example, one fully equipped computer lab per school, with 20 computers per lab and one mobile computer lab (i.e., a rolling table with one laptop, a projector and a printer);

3. Costs of teacher and maintenance staff training

**ANNEX 2.3 International and Regional Context**

Provide general background on relevant initiatives such as, for example, the Millenium Development Goals or Education for All.

International and regional fora and commitments can also be relevant. These include, for example, the European Union in Europe, CITEL in the Americas. CTU or CARICOM in the Caribbean, ASEAN in Asia, and COMESA, WATRA, ECOWAS, SADC, and CRASA in Africa.
ANNEX 2.4 National Context

More specific general background on the country will inform technology and cost choices. Relevant background includes economic data, demographics, and geographic information for each country and region.

There is also a need to set up and spell out the administrative, legal, regulatory and policy framework. It is also essential to delineate the economic actors, as well as other stakeholders.

ANNEX 2.5 National School Connectivity Action Plan

The Action Plan shall define:

- Who is in charge and who is consulted
- All legal and regulatory actions required to allow and facilitate connectivity
- School selection and phased implementation
- Technology selection
- Measures required for teacher training and support
- Maintenance and support mechanisms
- Costing and financing requirements and sources
- Monitoring and evaluation processes

ANNEX 2.5.1 NSCP Coordination

The establishment of a Joint NSCP Committee will ensure that there is:

- Identification of synergies between projects early on (at inception);
- Minimization of duplication of projects;
- Information-sharing across projects (i.e., “lessons learned”)
- Economies of scale and scope (for example, coordinating school installations with electric power infrastructure projects);
• Coordination of different schools’ needs through the Committee; Wholesale or “bulk” ordering of equipment and services through open, competitive procurement processes.

ANNEX 2.5.2 Legal and Regulatory Framework

In order to meet the NSCP targets, some changes to the legal, regulatory and policy framework may be required. These may include:

• **Revision of the legal and regulatory framework** to incorporate convergence and facilitate more efficient regulation of a liberalized market-place. These revisions, in turn, may include:
  ◦ Definition of flexible spectrum mechanisms and policies
  ◦ Revision of the licensing framework and fees
  ◦ Elimination of value-added taxes on Internet services provided to schools;
  ◦ Development of regulatory measures promoting the introduction of ICT in education, including national research and education networks;
  ◦ Further development of the access and interconnection regulatory framework and consideration of additional regulatory tools to promote effective competition, including open-access measures, collocation and infrastructure-sharing measures, number portability, etc.

• **The development of a national broadband policy and strategy**, including the definitions of key concepts such as “connectivity” and to review the definition of “broadband” on a national basis. The plan to consider how to continue using market reforms and liberalization as tools to encourage broadband deployment and to ensure appropriate application of broadband technologies;

• **The development of a universal access and service strategy**, and integration of school connectivity into universal service plans and financing mechanisms. This may involve:
  ◦ **The Development of a Rural Connectivity Strategy** to set out the manner in which the government will address the lack of access to ICTs in rural areas, as well as the integration of ICT into education and the creation of appropriate local content to avoid any in-country digital divide.
  ◦ The definition of **Universal Service Obligations**, which require operators to provide Internet service to schools at no cost, or at preferential rates;
The definition of universal service financing methods, including those needed for school connectivity. Financing may be achieved through subsidies or school voucher programmes or by financing equipment and connectivity through a universal service fund;

The introduction, through regulation or law, of an “e-rate” to assist all government and non-government primary and secondary schools in covering the ongoing usage charges for Internet access, as well as the initial connection charges;

- The development of legislation to ensure that cyber-crime, cyber-security, data protection and protection of minors are properly addressed; and

- The development of an e-waste programme to address environmental impacts of ICTs at schools.

ANNEX 2.5.3 School Selection and Phased Implementation

When deploying technologies to schools, it is also necessary to analyse how best to achieve a balance between equity and effectiveness. Deploying ICTs in different types of pilot schools will generate lessons on what and how technologies best fit into the different educational contexts, and how to increase ICT use at different school levels.

A phased implementation of school connectivity will also ensure that the implementation process is manageable and the development of best practices and lessons learned is gradual. It will also provide opportunities for monitoring and evaluation, so that the policy can be revised and fine-tuned.

ANNEX 2.5.4 Technology Selection

Technology selection incorporates a number of issues and choices, including:

- Connectivity options and alternatives,
- Methods to allow integration of emerging new technologies (m-learning, e-readers, etc.),
- The infrastructure that will support teaching and learning,
- How many students will be accommodated at one time (i.e., whether through one-on-one tutoring or computer lab solutions),
• Whether to procure new or used computers,
• What software to use (including open-source options),
• What information or network security measures to adopt, and
• How to integrate school management software with the learning management system.

There are numerous methods for connecting students, teachers, and schools to the Internet. These comprise solutions ranging from narrowband to broadband and are offered at varying costs. Availability of these technologies depends on what operators can provide, as well as the location. The use of satellite and wireless technologies has enabled some countries to reach marginalized areas or economically disadvantaged groups quicker.

ANNEX 2.5.5 Teacher Training and Support

Teachers will need to be acquainted with ICT integration and trained in basic ICT use, including word processing, spreadsheets and the use of the Internet, including social media. The Ministry of Education will generally be responsible for the training of ICT instructors, who will, in turn, train teachers and administrators.

Teachers and heads of departments from pilot schools should be expected to help train colleagues at schools that are connected in a later phase. In addition to training in techniques relating to the integration of ICTs into education, teachers should also be expected to have the necessary knowledge to guide students in surfing the Internet and understanding Internet issues.

Schools should also allow children to share experiences online and give them opportunities to show teachers and parents what they know. Teachers and parents also need to be trained and supported so that they can educate students and children about Internet safety. Government organizations, volunteer organizations and schools can provide training and support.

ANNEX 2.5.6 Maintenance and Support

Resources also need to be allocated for ongoing school connectivity operations, maintenance and upgrades. It is essential that schools have access to trained staff that can troubleshoot problems, perform routine maintenance and identify necessary upgrades, particularly in the more rural and
remote areas. Technical staff needs 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. Options can include receiving support and maintenance from the telecommunications operators, out-sourcing maintenance (which may be problematic in remote areas that are not close to support and maintenance facilities) or training of local staff.

ANNEX 2.5.7 Costing and Financing

A holistic approach is vital for the viability and sustainability of projects. Provision must be made for the long-term sustainability of the project through financing from a variety of sources. Government and donor funding cannot be the only sources of revenue for nation-wide coverage of schools. Schools should be encouraged to devise funding strategies for long-term sustainability of school connectivity.

ANNEX 2.5.7.1 Cost of Installation and Connectivity

In order to estimate the cost of connectivity, especially for use in the planning stages, a model must be developed based on a number of criteria, including geographical location and coverage by existing operators through fixed or wireless solutions.

The model must take into account the location of PBXs with ADSL capacity, the location of mobile base stations and the frequencies that will be used. It should also reflect information on schools’ locations and availability of electricity and fixed or mobile data and telephony services.

The application of the model should allow the estimation of costs for equipment installation and monthly connectivity charges, based on the technologies used and the current coverage of operating companies.

ANNEX 2.5.7.2 Total Cost of Ownership

An effective National School Connectivity Plan must take into account the total cost of ownership (“TCO”). Educational objectives, actors and funding must be channelled to address the key steps that
complement each other. The TCO includes the cost of deploying the infrastructure platform -- which is more than just the simple cost of acquiring computers and connectivity for schools. It also includes the cost of replacing equipment – both hardware and software as well as peripherals. Additional costs include security, electricity, maintenance of content and applications, ongoing user training and support, equipment maintenance and technical support, and monitoring and evaluation of the project.

Major operating costs associated with National School Connectivity Plans will also include personnel costs and usage costs. These are often the “forgotten costs” when projects are designed, even though they are critical for a project to be sustainable. Usage costs, which may be unpredictable if not properly regulated, form an important part of the TCO calculation.

ANNEX 2.5.7.3 Funding Strategies

Bearing in mind the mandated roles of all relevant bodies, their responsibilities for each element of the total cost must be addressed, and may include:

- Private-sector commercial rollout and other contributions
- Public/private partnerships (PPPs)
- Last-mile infrastructure subsidies
- E-Rate programmes
- Government allocations to schools as part of education budgets

ANNEX 2.5.7.4 Revenue Creation from School Connectivity for Sustainability

There are a few potential sources of income: community training, Internet usage (cyber), mobile charging, copying/document services.

ANNEX 2.5.8 Monitoring and Evaluation

Monitoring and evaluation (M&E) allows ongoing learning and feedback throughout the design, planning and implementation stages of a programme. As illustrated in the World Bank Handbook on Monitoring and Development of ICT in Education, a conceptual framework must be defined to guide
the monitoring and evaluation exercise so that relevant conclusions can be drawn and appropriate adjustments made.


Credits

This Module was updated in 2012 for the International Telecommunication Union (ITU) by Sofie Maddens-Toscano. This study was funded by the ITU.

It is one of five modules that are part of the Toolkit of Best Practices and Policy Advice, which ITU has created under its Connect a School, Connect a Community Initiative to identify and compile best practices for policymakers and regulators to connect schools to broadband Internet networks. The module is available on the ITU Connect a School, Connect a Community Portal, at:

http://www.connectaschool.org/itu-module-list
1 Introduction

A growing number of governments around the world are investigating or implementing pilots or programmes to distribute low-cost computing devices (LCCDs) for schools in their countries. The potential LCCD market is vast. According to the International Telecommunication Union (ITU), only 25 per cent of developing-country households had a computer and 20 per cent had Internet access. ¹ Considering the availability of computers in educational institutions, a wide disparity exists in the ratio of computers to students. For example, across Latin America in 2010, learners-to-computer ratios in primary and secondary schools ranged from 1:1 to 1:122. ² However, the increasing spread of mobile devices may help to improve access to educational resources. A 2011 McKinsey/GSMA study, for example, stated that “the increasing affordability of mobile devices, with entry-level feature phones costing as little as USD 20, can help m-education solutions transform education for 1.2 billion K-12 students, 160 million higher and vocational education students and many more lifelong learners around the world.” ³

This toolkit module examines the LCCD arena, analyzes costs, identifies implementation issues and reviews different countries’ experiences with LCCD programmes. The module also takes into account the increasing interest among policymakers, educators, vendors and other stakeholders in using mobile devices to achieve educational goals. Just a few years ago, the use of LCCDs in the classroom was limited to desktop and laptop computers. Now, there is emerging interest in how tablets, e-readers, smartphones and feature phones can be used in educational settings. Such devices are often less expensive and more portable than more traditional computer form factors, and they are expected to play an important role in expanding access to information and communication technologies (ICTs) among both students and educators, partly because of their increasing ubiquity. This module incorporates recent and ongoing developments in the use of such devices to enhance educational initiatives.
More specifically, Section 2 defines LCCDs and provides examples of devices that are currently being tested and deployed in school projects around the world. Section 3 identifies the various cost elements involved in LCCD deployments. In addition to the LCCD itself, there are other items that must be considered in implementing an LCCD project, including electricity, networking, software, training, transport and distribution and maintenance.

Section 4 examines implementation details such as coordinating LCCD programs and deciding which schools and students should receive LCCDs. Section 5 provides several case studies about LCCD deployments in different countries around the world. There is also a “checklist” for planning and implementation of an LCCD project.


2 Low-cost computing devices for education

Low-cost computing device is a relative term, given the wide differences in economic development around the world. A USD 100 difference in the price of a computer may not seem significant in a developed country but can make an enormous difference in a developing country. For example, in Benin, “…the cost of a generic PC is equivalent to a teacher's salary for eight months.”

The increasing prevalence of mobile devices, including lower-cost smartphones and more recently, tablets, also has sparked consideration of mobile devices as platforms for the delivery of educational content, or m-learning. This can include SMS messaging, multimedia live classroom sessions,
webcasting and podcasting, text recaps of lessons, educational games, multiple choice tests, and mobile whiteboards for interactive discussions.  

4 http://blogs.worldbank.org/edutech/print/497


2.1 The first LCCDs: computers and laptops in education

To many researchers, academics, development specialists and government officials, a low-cost computing device is a specific concept, grounded in a philosophical context. The idea behind low-cost computing devices developed from then-MIT Lab researcher Nicholas Negroponte, who articulated a vision of an inexpensive laptop for every child in the world.

A prototype of such a computer was shown at the World Summit on the Information Society (WSIS) in 2005. 6 Describing the benefit of LCCDs, former UN Secretary-General Kofi Anan said: "Children will be able to learn by doing, not just through instruction - they will be able to open up new fronts for their education, particularly peer-to-peer learning." He added that the idea was inspiring, with real potential for students’ social and economic growth in developing countries. 7

Initially, low-cost computing devices were considered to be laptops with rugged construction and low power consumption that were specifically designed for students in developing countries. However, several computer manufacturers now market laptops with similar features to the general public. The common features of LCCDs, regardless of the brand or specific functionality, are a relatively low price (less than USD 300 for the device), a laptop form factor, and a small size (e.g., screen size less than 10 inches).

The cost of computers has influenced national strategies for introducing information technology in schools. The typical way to reduce expenses has been to install a “computer lab” -- a shared location in the school where a few computers can serve multiple students. In many countries, the strategy has been to increase the number of such labs, introducing them into schools that previously had no
computers. For instance, in 2003 Indonesia adopted its “One School One Lab” programme aimed at expanding the availability of computer labs in its educational institutions.  

Another strategy has been to reduce the ratio of students to computers. Take Chile, for example, where the number of students per computer dropped from 70 in the year 2000 to 26 in 2007, with the government aiming for 10 students per computer by 2010. Lower-cost computers make it more affordable for countries to distribute them widely in schools.

One important distinction is the difference between “one lab per school” and “one computer per student.” Policies for introducing computers in schools have traditionally revolved around labs, with a number of students sharing one computer. The low-cost computer device movement is oriented towards each student having his or her own laptop:

“The mission of the One Laptop per Child (OLPC) movement is to ensure that all school-aged children in the developing world are able to engage effectively with their own personal laptop…”

“The ultimate goal is to reach the point where there is one laptop for each student…”

The one-to-one concept gives pupils more time on the computer than in a shared, lab-type environment. A calculation carried out for the Nepalese government found that a computer lab user only spends 1 per cent of the time on a computer that a student with an LCCD spends. The Solomon Islands initially explored providing each school with a computer lab, but with LCCDs, “…an even better outcome was ensured, as every child and teacher would have a laptop.”

Another model for reducing the cost of computers in schools is the “thin-client” approach, in which a simple computer (the “client”) is connected to a server that carries out most of the processing. This is similar to the environment that existed in the pre-personal computer era, when terminals were connected to host computers. This model is attractive from a cost perspective, since thin clients are cheaper than conventional computers. It is also attractive for a school environment where a teacher has more control over the computer learning environment. This solution has been used in rural schools in Brazil, where the cost per workstation is around USD 50.

While one-to-one computing is attractive, it is an expensive proposition. The cost of outfitting perhaps more than a billion developing-country students with their own laptops would be more than USD 100
billion (assuming a USD 100 cost for the laptop), not including all of the other associated costs, such as transport, distribution, maintenance and training. The advantages and disadvantages of different approaches—one-to-one computing or computer labs—are shown in the table below. Given the high cost of providing each student with their own laptop, this is not a feasible short-term approach for many developing countries; a more practical strategy may be a mix of approaches.

Table 2-1: Pros and cons of computer labs and one-to-one computing

<table>
<thead>
<tr>
<th>Model</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
</table>
| One computer per student (laptops/smartphones/tablets) | • Portability: Can be taken home and shared with family  
• Creates sense of ownership with less theft and damage  
• Some designed for developing country rural environment (e.g., handle extreme temperatures, low battery use, etc.)  
• Some designed for children (e.g., rugged, ergonomic)  
• Some include educational software and ecosystem of support  
• More democratic in that all children receive computers | • Relatively expensive  
• Can be disruptive  
• Applications optimized for smartphones/tablets still limited |
<table>
<thead>
<tr>
<th>Model</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer labs (recycled</td>
<td>• Rapid adoption of smartphones outside the school setting can be</td>
<td>• Higher maintenance and support, due to non-standard computers</td>
</tr>
<tr>
<td>computers, thin clients)</td>
<td>leveraged for educational use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Less disruptive than one-one model</td>
<td>• Students spend less time with computer</td>
</tr>
<tr>
<td></td>
<td>• Computer lab more economical than one-to-one</td>
<td>• Labs may not be equitably distributed throughout school system or</td>
</tr>
<tr>
<td></td>
<td>• More practical for shared settings such as computer labs or community centres.</td>
<td>computers can be dominated by certain students</td>
</tr>
<tr>
<td></td>
<td>• Generally more powerful than laptops</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generally more powerful than laptops</td>
<td></td>
</tr>
</tbody>
</table>

One way to offset such costs is to utilize used computers, which can also be considered low-cost computing devices. Although there are costs involved with recycling, the computer itself is generally donated for free. Furthermore, some experts argue that recycled computers can be cheaper than low-cost laptops when all of the costs are factored in, including waste and social benefit to the country. A study on the sustainability of computers for schools in Colombia suggests that used computers that are refurbished in the beneficiary country have the highest “utility,” which factors in benefits to the local economy, job creation, and the environment.  

In addition, as the prices of computing devices continue to fall, laptops that were not purpose-designed for educational use continue to be viable options for schools and students. Specifically, low-cost netbooks and laptops, which can cost less than USD 300, are widely available and can be deployed in educational settings, even if they may be more expensive than the education-specific products.
Leading examples of LCCDs include:

- **xo-1** – A laptop developed by One Laptop Per Child (OLPC), the xo-1 is specifically designed for primary school students in developing nations, and it has a range of features appropriate to that environment. The xo-1 design has factored in technological issues such as local language support, as well as environmental conditions such as high heat and humidity. It has no movable parts (e.g., no hard disk or fan), and it features special antennas to support mesh networking. OLPC has continued to improve the xo-1’s design and specifications since its initial introduction.

The xo-1 is backed by a large ecosystem of system designers, education experts and development specialists. The educational theories are tied into the operating system and software included with the xo-1 and the way it should be used. Dozens of nations are piloting or carrying out large-scale xo-1 implementations. Some of the most significant are Uruguay, where the government has provided xo-1 laptops to all public school primary students, and Rwanda, which, in addition to distributing xo-1s to schools, is also emerging as a research and training center for the xo-1.

- **Classmate** – A laptop developed by semiconductor manufacturer Intel as a “mobile personal learning device for primary students in emerging markets.” Originally introduced in 2006, the Classmate is built around an Intel processor and has a rugged, “kid-friendly” design. Features include hardware-based theft protection, Wi-Fi and a battery life of between 3.5 to 5 hours. The Classmate runs Windows or Linux and is available in clamshell or convertible designs. Intel has licensed the technology to various manufacturers.

According to press reports, more than 7 million Classmate Convertibles (which can be used as a laptop or a touch-optimized tablet) have been deployed across 70 countries. One of the largest deployments of the Classmate is in Portugal, which has contracted for around half a million of these laptops. The Classmate is used for the country’s *Magalhães* initiative (“Magellan” in English, named after the Portuguese navigator). Local company JP Sá Couto manufactures the computers. Portugal is leveraging the program to spread Magellan Classmates to developing countries. In September 2008, it signed a deal with the Venezuelan government to supply 1 million Portuguese-manufactured Classmates. The country’s incumbent telecommunications operator, Portugal Telecom, has targeted
the Magellan for overseas social responsibility programs, with plans to distribute the laptop in Lusophone Africa and Namibia.  

- **Netbooks** -- Encouraged by the LCCD movement for students, computer makers have been downsizing laptops to also tap into the market (e.g., netbooks). A noteworthy example in terms of price and entry into the educational market is the Asus Eee. Asustek, a Taiwanese computer manufacturer, has developed rugged portable computers for use in space, off-road races, Mount Everest and the North and South Poles. It introduced the Eee PC notebook in October 2007. The Eee, like the xo-1 and Classmate, is a portable laptop that uses flash storage, and the entry-level models are price competitive. But the Eee was not strictly designed for the educational environment as were some other devices. As with other commercial computers, it comes in a much wider range of configurations and models than the Classmate or xo-1. Since 2007, Asus has expanded the Eee line, but still offers Eee PC laptops that sell for less than $300.

One of the largest Eee educational deployments is in Russia, where it is being used in schools following an order for approximately USD 200 million from the Free Deed Foundation, a philanthropic organization. Some 1 million Eee PC 700 models were to be delivered between 2007 and 2012. The Eee has also been deployed in various school projects in the United States. It also emerged as the preferred LCCD in testing done at three African universities (it should be noted, however, that some LCCDs such as the OLPC xo-1 or Intel Classmate are not designed for university students).

- **Mobilis** -- Another LCCD that has been the focus of some attention is the Mobilis, manufactured by the Indian company Encore. The Mobilis was selected in a tender for school laptops in Brazil. Yet another is the Israeli-designed ITP-C, which is being used in school projects in Argentina and Chile. However, while these devices were part of early LCCD pilot projects, there has been no further known development of the devices or any additional deployments.

Figure 2-1: Low-Cost Laptops Used in Schools
<table>
<thead>
<tr>
<th>Manufacturer and Model</th>
<th>OLPC xo-1&lt;sup&gt;32&lt;/sup&gt;</th>
<th>Intel Classmate&lt;sup&gt;33&lt;/sup&gt;</th>
<th>Asus Eee</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Representative Image</strong></td>
<td><img src="image1" alt="OLPC xo-1" /></td>
<td><img src="image2" alt="Intel Classmate" /></td>
<td><img src="image3" alt="Asus Eee" /></td>
</tr>
<tr>
<td><strong>Representative Deployments for Education</strong></td>
<td>Afghanistan, Bhutan, Brazil, Cambodia, Colombia, Ghana, Guatemala, Haiti, India, Iraq, Lebanon, Mali, Mexico, Mongolia, Mozambique, Nepal, Nigeria, Niue, Pakistan, Papua New Guinea, Paraguay, Peru, Rwanda, Solomon Islands, South Africa, Thailand, Uruguay</td>
<td>Argentina, Brazil, Chile, China, Egypt, India, Indonesia, Lebanon, Libya, Malaysia, Mexico, Nigeria, Pakistan, Philippines, Russia, South Africa, Sri Lanka, Thailand, Uganda, Vietnam</td>
<td>Russia</td>
</tr>
</tbody>
</table>

Note: The list of countries where the devices are used in schools excludes developed nations.

6 The unveiling occurred during the “Phase II” conference and trade show, held in Tunis, 16-18 November 2005.

7 [http://news.bbc.co.uk/2/hi/technology/4445060.stm](http://news.bbc.co.uk/2/hi/technology/4445060.stm)


The theft protection links the Classmate to a school server. If the Classmate loses connection to the server for a certain period of time, it is rendered unusable and can only be reactivated if returned to the school. See: http://blogs.intel.com/technology/2009/08/classmate_pc_as_a_one-to-one_l.php

For a comparison of different commercially available low-cost laptops see: http://blog.laptopmag.com/low-cost-laptop-cheat-sheet
The xo-1 (previously known as the XO) was the first-generation OLPC laptop. It has subsequently been produced in upgraded forms, known as xo-1.5 and xo-1.75. Unless otherwise noted, all references in this module are to the first-generation xo-1.

2.2 Emerging LCCDs in education: leveraging mobile devices

The growing ubiquity of mobile devices creates new opportunities to change how students are educated and to change the relationships between student and teacher and between student and content. Mobile devices allow teachers and schools to make content available to students in a format that is portable and interactive, particularly if the format is optimized for mobile handsets. Because mobile devices are typically carried at all times, individuals can have immediate and constant access to current content, regardless of their physical locations. This has special relevance in developing countries and rural areas where traveling to a school can be long, expensive and inconvenient.

As tablet computers have entered the mainstream technology marketplace (primarily in developed countries), they are increasingly included in discussions of LCCDs, alongside smartphones. Apple’s iPad may be the most well-known mainstream tablet, but several devices have been released at
various price points, including some tailored specifically for the educational market and for developing countries. The expected advantages of deploying tablets in educational settings include lower costs compared with traditional laptop or desktop computers, as well as potential ease-of-use improvements due to their touch-screen user interfaces. Education-oriented tablets have been developed, or are being developed, by some of the same players involved in the low-cost laptop market, including Intel (with its Studybook) and OLPC (with the xo-3). In addition, e-readers, such as Amazon’s Kindle, offer an opportunity to make various types of content available to students, while also serving as literacy-improvement tools. E-readers, therefore, have been used in several pilot projects.

34 Op cit, p. 6.

35 For example, Hewlett Packard announced in February 2013 that it would begin selling a tablet for $169. Although it is not specifically designed for educational use, its relatively low cost could drive adoption in the education market. See http://www.nytimes.com/2013/02/25/technology/hp-offers-a-new-consumer-tablet.html?_r=0.


37 http://one.laptop.org/about/xo-3

2.2.1 Mobile devices for e-learning

Examples of low-cost tablets and e-readers include:

• xo-3 – OLPC’s follow-up to the xo-1 is the planned xo-3 tablet computer. The xo-3 features an all-plastic design that is semi-flexible and extremely durable. It has a display that can be optimized in both transmitting and reflective modes for indoor and outdoor lighting conditions. The xo-3 also can be recharged in several ways, including by solar power or a hand crank. Working prototypes were unveiled in January 2012, and the company expected to begin shipping xo-3 tablets that year for a price below USD 100. The xo-3 can run either OLPC’s Sugar operating system or Android.
• Studybook – Intel followed up its Classmate laptop with the Studybook tablet design. The Studybook is a ruggedized, purpose-built tablet specifically intended for educational use, as indicated by inclusion of Intel’s Learning Series Software Suite. The 7-inch tablets can run Windows 7 or Android, and may be updated to use Windows 8. As a reference design, Studybook will not be manufactured or sold by Intel, but the design will be licensed at no cost to any company interested in producing the device. Intel believes Studybooks can be produced at a cost of less than USD 200.

• I-slate – This tablet was developed by the I-slate Consortium, which includes hardware and software experts at Rice University in the United States, Nanyang Technological University (NTU) in Singapore, social outreach partners from the Indian non-profit Villages for Development and Learning Foundation (ViDAL), and a Los Angeles-based design team. The I-slate is billed as a "low-cost learning tool designed for classrooms with no electricity and too few teachers." The I-slate was first introduced in 2011, using custom-designed hardware and software intended to focus on usability and energy efficiency. It is meant to serve as an electronic notepad to replace the manual slates and chalk used by many rural Indian schoolchildren. The current I-slate is targeted as a self-education tool for fifth and sixth grade students in rural communities.

• Aakash/Ubislate – The Indian government, through the Ministry of Human Resource Development (MHRD), spearheaded a project to develop a computer specifically for college students. Initially envisioned as a laptop, over the course of its development the Aakash evolved into a tablet computer running the Android operating system. At its release in October 2011, the 7-inch Aakash tablet for Indian university students cost approximately USD 35 and featured Wi-Fi connectivity. A commercial version intended for wider distribution was known as the UbiSlate 7 and priced at approximately USD 50. In March 2012, MHRD reassigned responsibility for procuring and testing the device to the Indian Institute of Technology, Bombay. IIT Bombay has selected a vendor and is in the process of developing the Aakash 2 tablet, which will remain at a subsidized price of approximately USD 35 and was expected to be deployed before the end of 2012.

• Kindle – First introduced in 2007, Amazon’s Kindle family of e-readers comprises models with either an e-ink or LCD display and options for Wi-Fi or mobile network connectivity. The e-ink models run on a purpose-built operating system, while the LCD models use a modified version of the Android operating system. All Kindles are designed to provide easy access to electronic
books and other content from Amazon’s own ecosystem, but they can also display content obtained from third parties, including textbook publishers. Kindle Fire devices can run compatible Android applications and can easily access the Internet. There have been several pilot projects in the developing world involving distribution of Kindles to individual students or to classrooms. These include projects by Worldreader, a non-profit organization devoted to expanding access to digital books in developing countries. Kindle’s prices currently range from USD 69 to USD 499. These projects have provided devices preloaded with a selection of local and international reading material, as well as the ability to download additional material (as discussed in the case study on a Worldreader project in Kenya in Section 5.8 of the Module).

- iPod Touch – Introduced in September 2007, the iPod Touch is a device with the same form factor as many smartphones. It runs the iOS operating system that is shared by the iPhone and the iPad. In general, the iPod Touch has most of the functionality of an iPhone with Wi-Fi connectivity, but without mobile network connectivity and associated communication applications. The Touch has access to all compatible applications in Apple’s App Store, including applications intended for educational use. Apple notes that the App Store has more than 20,000 educational applications, including iTunes U, which is a platform for teachers to distribute classroom material directly to students' devices.

Figure 2-2: Low-cost tablets/e-readers used in schools

<table>
<thead>
<tr>
<th>Manufacturer and Model</th>
<th>OLPC xo-3</th>
<th>Intel Studybook</th>
<th>I-Slate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Representative Image</td>
<td><img src="image1" alt="OLPC xo-3" /></td>
<td><img src="image2" alt="Intel Studybook" /></td>
<td><img src="image3" alt="I-Slate" /></td>
</tr>
<tr>
<td>Representative Deployments for Education</td>
<td>Expected availability in 2012</td>
<td>None known</td>
<td>India</td>
</tr>
<tr>
<td>Manufacturer and Model</td>
<td>Aakash/Ubislate</td>
<td>Kindle</td>
<td>iPod Touch</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------</td>
<td>--------</td>
<td>------------</td>
</tr>
<tr>
<td><strong>Representative Image</strong></td>
<td><img src="image" alt="Aakash/Ubislate" /></td>
<td><img src="image" alt="Kindle" /></td>
<td><img src="image" alt="iPod Touch" /></td>
</tr>
<tr>
<td><strong>Representative Deployments for Education</strong></td>
<td>India</td>
<td>Ghana, Kenya, Tanzania, Uganda</td>
<td>None known</td>
</tr>
</tbody>
</table>

Note: The list of countries where the devices are used in schools excludes developed nations.


44 Reference design released in mid-2012.
2.2.2 Mobile communications growth

Mobile subscriptions continue to exhibit tremendous growth, especially in developing countries. Global mobile penetration is now 87 per cent in the developed world and 79 per cent in the developing world. Meanwhile, mobile broadband subscriptions grew at an annual rate of 45 per cent between 2007 and 2011, resulting in twice as many mobile broadband subscriptions as fixed broadband subscriptions. In the developing world, mobile broadband is often the only broadband access option available, given the generally low penetration of fixed broadband infrastructure. Even so, mobile broadband penetration in the developing world (8 per cent) lags significantly behind the developed world (51 per cent).

There is significant variation in mobile penetration across and within regions. For example, within Africa, 25 countries were responsible for 91 per cent of mobile subscriptions. And although Africa represents the fastest growing and second-largest mobile phone market in the world, it has the lowest mobile broadband penetration of any region; the mobile broadband penetration rate is below 5 per cent, while all other regions exceed 10 per cent. The Asia-Pacific region continues to be the largest mobile market in the world, with 3 billion subscribers as of 2011, and an expectation that a further 1.5 billion subscribers will be added by 2015.

By comparison, Latin America is now the third-largest mobile market, with more than 630 million mobile connections as of the end of 2011. The market is beginning to mature, and its 13 per cent annual growth between 2007 and 2011 is expected to slow to 5 per cent by 2015.

However, the fact that mobile broadband penetration rates average only 51 per cent even in the developed world means that there is still significant room for growth. In 2011, mobile broadband saw 40 per cent annual subscription growth. As mobile broadband penetration increases, especially in the developing world, there will be increased potential for delivery of educational services over mobile devices.

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2.2.3 Use of mobile handsets in education

There have been several pilot projects to incorporate mobile handsets into classroom learning environments. Such projects have focused on engaging students with their current lessons, as well as activities like conducting student assessments.

One such project is called Seeds of Empowerment. An outgrowth of a research project at Stanford University in the United States, it aims to increase access to basic education for children living in extremely marginalized communities around the world. \(^{53}\) Researchers partner with local organizations to provide mobile devices to students and schools. Seeds of Empowerment projects were launched in 2008 in Argentina, Mexico, and El Salvador, and additional projects were anticipated in Bolivia, Brazil and Uruguay in 2012. Early Seeds of Empowerment projects provided students with a purpose-designed device called a TeacherMate, but later projects have used smartphones with Android or iOS.
operating systems. The smartphones provide access to an educational platform called the Stanford Mobile Inquiry-based Learning Environment (SMILE), which allows students to perform self-evaluations and peer assessments.

In 2011, Paraguay’s Ministry of Education launched the Learning Assessment through Mobile Phones (LAMP) pilot project to explore how to administer standardized tests through mobile phones. The project, which focused on mathematics and Spanish language and literature, addressed key content areas of the national curriculum for secondary school students. The project also included training for teachers and school directors to help students prepare and to provide them with technical support. The use of text messaging as the medium for students to receive and respond to multiple-choice questions enabled the responses to be uploaded directly to the Ministry of Education’s database, increasing the speed for processing test results. The results of the project, as well as an evaluation of its methods, will be included in a future report to be published by the Ministry of Education.


54 Op cit, 21.

2.2.4 Educational benefits of mobile devices

Increasingly ubiquitous mobile devices, including feature phones, smartphones, and tablets, can help achieve a number of macro-level educational goals. Mobile phones have a 79 per cent penetration rate in the developing world (with a growing adoption rate for smartphones), compared with the percentage of homes that have computers (only 25 per cent).

Mobile devices can provide a level of reach, scope and immediacy that is largely unattainable through traditional classroom environments. The most up-to-date content can be accessible immediately -- from anywhere -- and it can be repeatedly reviewed for better comprehension and understanding. The typical mobile learning (m-learning) student saves 86.7 per cent of the money spent for a student taking the same training through a traditional classroom. Among the goals that can be addressed through the use of mobile devices are:
• **Access to education**: By increasing access to education for all children, mobile devices can help achieve universal primary education and promote gender equality. According to the Global Campaign for Education, 69 million children worldwide still have no formal education, and 774 million adults cannot read or write. In addition, many young people considered educated have significant gaps in the quality of education they have received. Using mobile devices to increase access to education can help address each of these needs. Increased accessibility can provide rich educational opportunities for students who have traditionally lacked access to high-quality schooling. Such students often include girls -- who may not be offered the same educational opportunities as their brothers or male neighbors -- as well as the disabled.

• **Skills instruction**: Mobile devices can improve access to training and instruction, which can have a long-term, sustainable and positive impact by helping people attain decent and productive jobs.

• **Health education**: Mobile devices can provide access to information necessary for preventing diseases and making informed health decisions. An e-learning initiative in Kenya, for example, upgraded nurses’ skills and increased the amount of registered nurses from 100 trained per year under traditional programmes to more than 1,300 per year in a short period of time. However, while only 20 per cent of those nurses had access to a computer, all had mobile devices. With a global shortage of 3.4 million health workers, m-learning seems like a logical tool to employ in addressing this gap.

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57 Dr. David Ngaruiya. Kenyan Faculty member of NIST, in an interview with David Rogers, University of Central Florida.

2.2.4.1 Benefits for students

Mobile devices are not a panacea for replacing or radically redesigning existing curricula. In fact, many educators who have incorporated them into their classrooms use them to support and enhance existing curricula. For example, mobile technologies can enable peer-to-peer learning and remote tutoring through social networking services. This is the goal of the Mixable application, launched at Purdue University in the United States. Mixable – a web and mobile application – enables students to leverage the social media and sharing tools they already use, such as Facebook, Twitter and Dropbox, to discuss and share information relevant to their coursework. Even without a purpose-built application, mobile devices that enable access to social networking sites can be used by teachers and students to share resources, as well as to provide a forum for support, discussion and collaboration.

Mobile devices also allow educators to personalize educational content for students. Rather than using a static textbook, teachers can incorporate applications or mobile-accessible content tailored to each student’s skill level or progress. Similarly, small-scale m-learning programmes can promote development of curriculum at the local level to suit the cultural idiosyncrasies and particular needs of local children or the continuing education of the populace.

The rapid adoption of mobile phones, along with the increasing availability of other mobile devices, can also provide literacy benefits. Particularly in developing countries, investments in mobile applications or devices can be more cost-effective than procuring and distributing physical textbooks and other printed resources, especially in rural areas. In many countries, mobile devices may be the only channel for effectively distributing reading material. As e-readers continue to proliferate and decrease in price, they offer a new avenue for lowering the cost of providing educational materials to students worldwide.

Literacy is often a key goal of m-learning initiatives. Colombia’s Ministry of Education, together with the Ministry of ICT, and the Organization of Ibero-American States, has designed the largest mobile learning initiative in Latin America. With 1.67 million illiterate people aged 15 and older, the government plans to distribute 250,000 mobile devices and accompanying SIM cards in the project’s
first stage. These will be pre-loaded with six modules of interactive and self-directed educational content designed to increase users’ literacy and basic skills. The devices and cards will be delivered for free, and no internet connection will be necessary to access the content. The first stage of the project was expected to be implemented in 2012. 62

Even the ubiquitous mobile feature phone (not a smartphone) can be a powerful medium to distribute reading material. Worldreader, a non-governmental organization (NGO) best known for its distribution of e-readers to improve literacy in Sub-Saharan Africa, also offers an application for feature phones and smartphones that provides access to public domain books, as well as contemporary fiction and non-fiction. 63 Yoza Cellphone Stories is a project to support reading and writing by South Africa’s youth by making a variety of reading material available over mobile phones. 64 The literature available over Yoza – including mobile novels (“m-novels”), Shakespeare plays, and poetry – resulted in 300,000 reads over its first year, as well as generating 40,000 comments in social media. 65

In addition, mobile devices provide a medium for developing “information literacy,” or the ability to find, use, and communicate information effectively and ethically. 66 By providing expanded access to information sources and improved ability to communicate with other students, teachers and subject-matter experts, mobile devices can greatly expand students’ ability to grow into sophisticated researchers and critical thinkers.

Developers are producing an ever-increasing number of educational applications for mobile devices intended to address a wide range of subjects, skill sets and demographic groups. One Chilean application, for example, is intended to increase access to higher education. Chile has one of the highest graduation rates for secondary education in the region, but enrollment in post-secondary education shows significant gaps among different socio-economic groups. One of the reasons for this disparity is that students from lower-income groups perform poorer on the Prueba de Selección Universitaria (PSU) -- the national university admissions test -- compared with students from higher-income groups. This gap has been partially attributed to a lack of access to test preparation materials. PSU Móvil is an application developed to provide free access to packs of exercises, games, and podcasts, sorted by topic. It also contains a calendar of important PSU dates, deadlines, and diagnostic results for completed practice exercises. 67
In rural and remote communities, the connectivity offered by mobile devices can substantially strengthen educational efforts. For example, SMS messaging can be used as a one-to-many tool for teachers to distribute information, assignments, or assistance to widely dispersed students. Students and educators can take advantage of social media platforms and other collaboration tools to form virtual communities that support, assist and challenge each other. Social networking is not limited to one or two platforms. While Facebook may have 1 billion or more active users worldwide, other networks also are highly active. MXit, a social network based in South Africa, boasts nearly 50 million users, who send an average of 750 million messages daily. MXit users are primarily African, with only 10 per cent located elsewhere.

While this section has focused on the use of mobile devices for delivery of educational content and services primarily in a classroom setting, m-learning can be targeted at learners outside the traditional school system. For example, mobile learning services can be oriented toward vocational education and training, as well as professional learning and development. The lessons learned in the provision of mobile education services to primary, secondary and post-secondary schools can be applied to other scenarios, and vice versa.

60 See http://www.itap.purdue.edu/studio/mixable/.


64 http://www.yoza.mobi

2.2.4.2 Benefits for teachers and administrators

Mobile devices and associated training can also be used to develop the human capital of teachers.

There is a global shortage of teachers, primarily in areas with high poverty rates. In addition, many teachers around the world are unqualified or underprepared to meet the educational demands of the 21st century. Mobile devices can facilitate faculty mentoring and participation in online professional communities, making it easier for teachers to share best practices within their schools and with counterparts at other institutions, as well as to collaborate and motivate one another. Mobile devices increase teachers’ accessibility to rich repositories of free online lesson plans and educational content that can be downloaded, reviewed, and even projected or printed.

For example, Mozambique’s Ministry of Education has adapted curricular materials for mobile phones and created multiple versions to accommodate particular cultural and linguistic contexts. The United States Department of Education has worked to make its online resources easily searchable. Many such databases seeking to freely disseminate content already exist, including projects by universities such as Stanford, Harvard, and MIT. These platforms contain systems for testing, grading, providing student-to-student assistance, and awarding certificates of completion.

Further, leveraging the ubiquity of mobile phones allows teachers and schools to improve communication with parents and students. Without the need for complicated applications or even
smartphones, educators can call or text students and parents to keep them apprised of information ranging from assignments or attendance to the availability of new resources or important news about school facilities. Similarly, mobile technology can be used to improve communications between school administrators and teachers. The SMS for Better Schooling in Sindh (Pakistan) initiative involves 400 schools and uses text messages to inform schools and communities about such developments as the planned delivery of new textbooks – and to check in to make sure that the textbooks have actually arrived and are in use. Other services being monitored include the state of lighting in classrooms and the quality of drinking water in schools.  


71 Ibid.

72 Ibid.

73 Ibid.

74 See, for example, Federal Resources for Educational Excellence at http://free.ed.gov/.


2.2.5 M-learning initiatives: characteristics and challenges

M-learning initiatives are relatively new and can vary tremendously in a number of respects. So, it is difficult to definitively identify the key factors in designing or implementing a successful programme.
However, the emerging body of literature on ICTs in education and the growing number of m-learning programmes and pilot projects enable the identification of a few potential best practices.

### 2.2.5.1 Characteristics of successful m-learning initiatives

Several examples of m-learning programmes have been developed to meet the specific needs of a community or in response to a government request. For example, the BBC World Service Trust developed its Janala program to roll out English lessons in Bangladesh after the government identified the need for improved English skills. Students dial “3000” to access hundreds of three-minute audio lessons. They can then assess their progress with interactive audio quizzes. Nine months after launch, this service had attracted 3 million calls with a high rate of repeat users. \(^77\)

It may make good business sense to mass produce content whenever feasible in order to spread the cost of content over a larger user base. But it is essential to develop local content and keep it relevant. \(^78\)

M-learning projects should have a clear sense of the mix of local, regional or international content that would be most useful to the target population.

To the extent possible, implementation of device-agnostic solutions should help to make m-learning programmes available to the widest possible audience without needing to customize them for a variety of mobile handsets or other devices. \(^79\) For example, SMS-based services are accessible to nearly any mobile handset, while content delivered over mobile-optimized websites should be accessible to any Internet-connected device with a web browser, including smartphones, tablets and even some feature phones.


\(^78\) Ibid.

\(^79\) Ibid.
2.2.5.2 Challenges to mobile learning initiatives

There are certainly challenges and obstacles to mobile learning initiatives:

- Currently, most of the projects testing m-learning are either small-scale pilots or isolated initiatives not built with scale and sustainability in mind. The scale aspect is unfortunate because of the great advantage educators and governments could leverage in using mobile devices on a larger scale to reach students who are unreachable by traditional teaching methods.

- Many projects are informal or have not been formally studied or researched, making it difficult to understand the “big picture” of m-learning initiatives globally.

- M-learning does not eliminate the need for face-to-face training for teachers and other educators. Teachers often require face-to-face support to really change their behaviour and adopt plans that use mobile and other new technologies.

- Although mobile devices offer access to new resources and teaching or learning methods, they remain only one of many tools available to educators and policymakers. Professional development should show teachers how to integrate mobile technologies with other tools.

- Due to the dynamic nature of the mobile landscape, it is challenging to integrate mobile technologies into educational practices in a timely fashion. When the primary goal of many initiatives is to ensure that every child receives an elementary education, leveraging up-to-the-second technology often does not seem necessary.

- There is a lack of educators developing content.

The chancellor of the largest teacher training institute in Mexico, for example, noted that her country offers a case study of some of the obstacles and challenges involved in using technology, including mobile technology, to improve teaching and learning:

- Mexico made substantial investments in education that yielded very poor results.
- Students often receive CDs in lieu of textbooks, but do not have devices to play the CDs.
- Many teachers did not know how to use technological materials, so the materials failed to promote learning. Ultimately, the large investment was wasted because of teachers’ low user skills.
It is also worth noting that there is tremendous variety with respect to m-learning initiatives within and across regions. This is due to the perceived gaps or opportunities that m-learning can address, as well as the resources available to implement such programmes. The challenge – and benefit – of this variety is that there is no single preferred approach to incorporating mobile devices into classroom curricula or other educational settings.

m-learning is still in an early stage, with significant additional research, trials and support necessary to more fully evaluate its effects and identify best practices. To that end, UNESCO was expected to release guidelines on m-learning by the end of 2012, as part of its M-Learning Policy Guidelines Project. The goals of the project are to “guide national governments and education institutions on policy choices that can support and enable education delivery through the safe, affordable and sustainable use of mobile technologies,” as well as to develop the future of mobile learning beyond the Education for All goal year of 2015. Draft guidelines were in circulation as of August 2012.

80 Op cit, at 9.


82 Ibid.

83 Ibid.

84 Op cit, at 11.

85 Op cit, at 12.

86 Op cit, at 16.

87 Ibid.

2.2.6 Potential negative effects of mobile devices in classrooms

While there are important opportunities and possibilities for the use of mobile devices in educational settings, there are certainly potential negative effects as well, including the following:

- Without proper training and planning, the introduction of new technology into the classroom can distract from the core educational missions of schools and educational institutions.
- Without some combination of training, enforcement, or access restrictions, mobile devices run a significant risk of distracting students – and teachers – from educational pursuits.
- Similarly, access to mobile devices in the classroom creates additional opportunities for students to cheat, whether by researching test answers or sharing work with other students.
- If mobile devices are tightly integrated into lesson plans and curricula, the lack of a mobile device – whether due to affordability, loss, damage or other reasons – can put students at a disadvantage relative to their peers.

While these effects are not limited to mobile devices, the fact that mobile devices are, almost by definition, relatively small, can make it more difficult for educators to monitor their use.

3 Low-cost computing device cost elements

There are a variety of direct and ancillary costs involved in the implementation of a low-cost computing program. The initial costs include the LCCD, software licences (if not included with the LCCD itself), as well as certain peripherals (printers, additional memory, etc.), network access, and development of content specifically for the LCCD program.

Other costs involve taxes, as well as the transport and distribution costs related to the deployment of the LCCDs. The size of the country can have an impact on distribution and transport costs. A smaller, more urbanized, country will have lower costs than a large, rural one. The training of pupils and teachers on the LCCD is another initial, ancillary cost.
There are also a variety of ongoing costs related to an LCCD program. These include costs related to the maintenance of devices, software upgrades, security, ongoing network access costs, electricity, and staff costs, if applicable.

The above-mentioned initial and ongoing costs will vary substantially, depending on the scope of the program. Some projects are national (e.g., hundreds of thousands of LCCDs for a nationwide implementation in Uruguay) whereas others are more localized (e.g., a 30 LCCD pilot in Mali). The magnitude of the LCCD implementation has economy-of-scale implications for various elements, such as the price of the LCCD.

The software that comes with the LCCD, along with government policies for applications and educational content, affects software costs. Some countries may find that the applications that come with the LCCD are sufficient for their needs while others may want to use applications that can be downloaded at no cost via the Internet or purchased commercially. In terms of educational content, there are hundreds of free packages and applications.

Content is already available in some countries, even if it sometime must be modified to run on the LCCDs. Brand-new content may need to be developed in other countries. Some costs can be internalized, such as training or content development. In other words, rather than requiring additional government educational expenditures, elements of the LCCD project may have no impact on budgets if the activities already exist in government school systems. For example, there may already be a content development centre for computers. Governments might be able to transfer funds from educational activities that are no longer a priority to new LCCD projects.

Given this diversity in scope, it is possible to anticipate the necessary cost elements, but difficult to provide specific costs associated with these cost elements, since this will vary significantly based on the scope of the program and the country in which the program is being deployed.

Figure 3 -1: LCCD cost elements
3.1 Infrastructure

*Infrastructure* refers to the ICT hardware and other infrastructure components typically required for an LCCD program. Apart from the cost of the LCCD itself, other physical elements need to be factored into an LCCD program, including peripheral components for the LCCD, networking, servers and electricity.

### 3.1.1 The low-cost computing device

Although one of the goals of the one-to-one computing movement was a USD 100 laptop, this has yet to be achieved on a widespread basis, although some tablet devices have (or are expected to have) costs below the USD 100 threshold. LCCD costs vary depending on brand, configuration and the number purchased. The unit prices of various LCCDs are shown in the table below. This assumes purchase of a single unit with default configuration and does not reflect volume discounts.

Table 3-1: Unit Price of Various LCCDs

<table>
<thead>
<tr>
<th>Type of LCCD</th>
<th>Price (USD)</th>
<th>Remark</th>
</tr>
</thead>
</table>

connectaschool.org
<table>
<thead>
<tr>
<th>Device</th>
<th>Price</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLPC xo-1</td>
<td>199.99</td>
<td>Price for donating a new OLPC to a child in a developing country. 90</td>
</tr>
<tr>
<td>Classmate PC</td>
<td>429.00</td>
<td>Manufacturer’s retail price for the following model: CTL 2go</td>
</tr>
<tr>
<td>(convertible)</td>
<td></td>
<td>Classmate PC E12 Value Netbook (1.6 GHz Intel Atom Dual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Core Processor, 2 GB RAM, 250 GB Hard Drive, Windows 7)</td>
</tr>
<tr>
<td>ASUS Eee PC</td>
<td>211.68</td>
<td>Price on Google Product Search for following model: 10”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X101CH Eee PC</td>
</tr>
<tr>
<td>Studybook</td>
<td>579.00</td>
<td>Manufacturer’s retail price for CTL 2go Studybook L7</td>
</tr>
<tr>
<td>I-Slate</td>
<td>45</td>
<td>Estimated price as per I-Slate creator Krishna Palem, assuming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sufficient volume is reached.</td>
</tr>
<tr>
<td>Aakash/Ubislate</td>
<td>35/65</td>
<td>Aakash is subsidized by the Indian government, while the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>essentially identical Ubislate is a commercial product.</td>
</tr>
<tr>
<td>Amazon Kindle</td>
<td>69</td>
<td>Price for 6” Kindle with e-ink display and Wi-Fi connectivity.</td>
</tr>
</tbody>
</table>

Note: The list excludes upcoming devices without firm pricing information.

Furthermore, because many LCCD projects are still pilots using donated equipment, it is difficult to get a firm figure about the price of LCCDs. At the same time, large-scale implementations have typically involved many other cost elements, also making it difficult to isolate just the LCCD cost.

Another perspective on the costs of the LCCDs is to look at project costs in various implementations around the world. One difficulty is that they typically include other items besides just the device itself.
However, the resulting price per LCCD is still cheaper than average per unit prices and thus provides an insight into the impact of volume discounts.

Table 3-2: Cost of LCCD Programs in Various Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Date</th>
<th># of LCCDs</th>
<th>Total (USD million)</th>
<th>Price per LCCD (USD)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>Dec-08</td>
<td>150,000 (Mobilis)</td>
<td>35.2</td>
<td>235</td>
<td>Including delivery to schools, taxes, 12-month guarantee, maintenance and equipment configuration.</td>
</tr>
<tr>
<td>Haiti</td>
<td>Feb-08</td>
<td>13,700 (XO)</td>
<td>5.1</td>
<td>372</td>
<td>Including training, electricity, content development and networking. LCCDs valued at USD 146.</td>
</tr>
<tr>
<td>Kenya</td>
<td>Jun-11</td>
<td>65 (Kindle)</td>
<td>0.019</td>
<td></td>
<td>Included 3G-capable e-readers</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Jun-09</td>
<td>93,000 (Intel)</td>
<td>9.9 per year</td>
<td></td>
<td>Budget includes hardware as well as software and training</td>
</tr>
<tr>
<td>Russia</td>
<td>Sep-08</td>
<td>1,000,000 (Eee)</td>
<td>200</td>
<td>200</td>
<td>Information is not available about what this amount covers.</td>
</tr>
<tr>
<td>Thailand</td>
<td>Jul-12</td>
<td>900,000</td>
<td>59</td>
<td>81</td>
<td>7-inch Android tablet from a Chinese supplier</td>
</tr>
</tbody>
</table>
In addition, cost information is not made public in some cases. For example, Colombia’s Ministry of Education in October 2007 launched a pilot project to evaluate one-to-one computing models in school settings. The project began with a donation of 300 Intel Classmate PCs, but will expand to include 1,500 computers. No project cost information has been released to date, and the description of a “donation” of computers from Intel indicates that per-unit cost information is likely to be unavailable.

LCCD pricing information is also sometimes speculative as projects move from concept to production and deployment. As noted, India’s government has driven the development of the Aakash tablet, intended for educational use, with a target of distributing approximately 230 million devices to urban university students. The development process has been delayed, but the government still expects to provide the devices at a subsidized cost of approximately USD 35 per unit. Also in India, the consortium behind the I-Slate announced an agreement to provide 50,000 devices to middle school and high school classrooms in one district over the next three years. The consortium expects the price to be approximately USD 45; however, such pricing is contingent upon reaching target production volumes.


As of 2012.

Amount available from 2012 government budget, reported as enough to cover the cost of the first 750,000 tablets.

3.1.2 Additional hardware components

The LCCDs described in Section 2 are ready to use as-is and come with a number of features that may include Wi-Fi network capability, integrated cameras and microphones. Additional components for the LCCDs might be needed, depending on what each country or community deems necessary. These primarily revolve around storage, connectivity and peripherals.

- **Storage**: Most LCCDs used for education come with flash memory-based storage rather than hard disks. The storage capacity varies. If the storage is deemed insufficient, then the cost of obtaining additional higher capacity would need to be factored into the unit cost. Extra storage could also be supported through a school server.
- **Connectivity**: All of the LCCDs come with Wi-Fi connectivity and/or mobile network connections. However, in order to connect Wi-Fi-only devices to the Internet, access points need to be provided. This is discussed under servers below. In addition, most LCCDs do not include Bluetooth connectivity, so if that is deemed important, then the cost of Bluetooth adapters would need to be included.
- **Peripherals**: Printers and scanners might also be needed.

The table below provides some indicative prices for additional hardware that might be needed.

Table 3-3: Prices for additional hardware

<table>
<thead>
<tr>
<th>Product</th>
<th>Brand</th>
<th>Price (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluetooth adapter</td>
<td>Bluetooth USB 2.0 Micro Adapter Dongle</td>
<td>1.32</td>
</tr>
<tr>
<td>USB Flash Drive</td>
<td>SanDisk Cruzer 4/8/16</td>
<td>5.73/1.71/9.83</td>
</tr>
<tr>
<td>Printer/Scanner</td>
<td>Canon PIXMA MG2120 all-in-one Printer</td>
<td>44.95</td>
</tr>
</tbody>
</table>

Note: Lowest price brands (excluding tax) for each product according to Amazon USA (accessed October 2012).
In the case of devices with mobile network connectivity, a subscription may be required (or a user can pre-pay), although this is not a hardware item.

### 3.1.3 Taxes

Import duties, Value-Added Taxes (VAT) and other taxes add to the cost of the LCCD and peripherals. Policies vary widely regarding the extent to which these taxes are applied.

The World Trade Organization Ministerial Declaration on Trade in Information Technology Products (ITA) was agreed to by 29 participants in 1996. The number of participants has grown to 74, representing about 97 per cent of world trade in information technology products. The ITA calls for the total removal of import duties on ICT goods. Many developing countries, the targeted group for most LCCD projects, have not signed the ITA. Nonetheless, some countries have eliminated import duties on computers even though they are not ITA signatories. In May 2012, many signatories signaled that they would begin informal bilateral and multilateral consultations on expanding the list of products covered by the ITA.  

Import duties are sometimes used to encourage local assembly, refurbishment or manufacturing. In Brazil’s government auction for LCCDs, one of the alleged reasons OLPC had higher costs than its competitors was because it had to include the cost of import duties. Some other bidders were offering domestically produced computers. In Colombia, imported LCCDs have been rejected as the lowest-cost solution for schools because they do not add as much to the economy as domestically refurbished computers.

Therefore, the impact of taxes on the LCCD program will vary from country to country. As noted, import duties are not an issue in countries that have abolished duties on information technology equipment. VAT also may not be applicable if the computers are shipped directly to the government instead of going through a third party.

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94 In the case of devices with mobile network connectivity, a subscription may be required (or a user can pre-pay), although this is not a hardware item.

3.1.4 Security

Security costs must be contemplated to minimize the theft of the LCCDs. For example, both the xo-1 and the Classmate have built-in security features, reducing the need for additional expenditures. The Classmate has hard-wired anti-theft features,\(^96\) while the xo-1 uses software-based security.\(^97\) While these systems will generally render the LCCD unusable for unauthorized users, they may not be sufficient to reduce physical thefts, particularly if the thief is not aware of these features. Having students take the LCCD home at night can reduce security costs. Conversely, having a locked or guarded location to store the LCCDs should be considered. As tablets and smartphones are increasingly included in LCCD deployments or projects, there may be increased potential for theft given the devices’ smaller sizes.


\(^97\) [http://wiki.laptop.org/go/Bitfrost#Current_Status](http://wiki.laptop.org/go/Bitfrost#Current_Status)

3.1.5 Transport

Transport can form a significant part of the costs of providing low-cost computing devices. LCCDs need to be transported from the manufacturing location to the destination country. Each country’s costs for distribution of LCCDs will vary tremendously, depending on the distance from the LCCD manufacturing locations and the breadth of deployment, as well as the shipping method. Once in the country, the LCCDs then must be transported to different schools.

Priorities will dictate whether to use air or surface transportation. The former is more expensive (items are typically priced by weight) but quicker, whereas the latter is less expensive (items typically are priced by volume). There may additional costs if the LCCDs need to be assembled or reassembled once in the country. All of these factors make it difficult to provide a common figure for transport costs.
Transportation problems affect the LCCD program. For example, in the Solomon Islands, laptops could not be distributed to some schools because of logistics, and some teachers could not be briefed on the project because of a lack of fuel to transport them. \(^98\)


### 3.1.6 Adaptation for the disabled

Since most LCCD projects are still pilots with few large-scale deployments, limited resources have been directed at making them usable by disabled children. Nonetheless, certain countries, such as Portugal, Russia and Uruguay, have introduced measures to make LCCDs accessible for those individuals.

For example, an online forum exists for using the xo-1 laptop as an assistive technology for disabled persons. \(^99\) The Portugal Telecom Foundation has also carried out numerous projects to modify computers for use by disabled persons, including children. \(^100\) In Russia, a project was initiated to provide LCCDs for blind students.

At this stage, it is too early to determine the costs of making adaptations in each country. However, various groups are working on projects that will provide a track record, through shared experiences, to identify ways to reduce costs. In addition, charitable organizations, whose donations are often targeted for the disabled, could provide a funding resource to defray the costs of making computing devices accessible to disabled children.

With respect to mobile handsets, a number of design or hardware features have become widely available to assist the disabled. \(^101\) For example, individuals with impaired hearing can benefit from text and multimedia messaging, visual or vibrating alerts and hearing aid compatibility. Similarly, blind individuals or those with impaired vision can take advantage of tactile markers on buttons or controls, audible or tactile feedback, adjustable brightness and contrast controls, and a backlit display. All of these features can be used by students with disabilities to help them access educational materials.

3.1.7 Servers

LCCD programs can be significantly enhanced through the inclusion of computer servers. These computers are generally more powerful than the LCCDs and provide a range of services, including Internet connectivity, printer sharing, file downloading and disk storage. Assuming such services are desirable, then the cost of the servers, peripheral devices such as printers and networking costs must be factored into the LCCD project.

Since LCCDs do not have sufficient capability to function as servers, most countries use more powerful computers. The price of the servers varies by the amount of RAM, processor speed, disk capacity and computer brand. In some projects, one server is purchased per school. In addition, the purchase of printers and scanners needs to be contemplated, along with consumables such as paper and ink cartridges or laser toners.

Most LCCDs have Wi-Fi capability but require connectivity through an access point to the Internet if there is no mobile network connectivity, which requires both included hardware and an active subscription. Although a server is not needed for Internet connectivity, it can provide additional features such as better network security and management. In addition, performance can be enhanced by storing applications and content on the server for distribution to the LCCDs instead of each student accessing the Internet to download files.

Other costs associated with Internet access include the cost of routers and monthly subscription fees. Depending on the type of Internet access, additional adapters may be required. For example, if the connectivity is through a mobile network, then a wireless network adapter will need to be purchased. Given the added complexity of computer servers and Internet access, some countries have outsourced the support and maintenance of their equipment.
3.1.8 Electricity

The availability of electrical power has a major impact on the scope of an LCCD program. Some form of electrical current is needed to recharge the LCCD devices and power servers for supporting the program. Power costs can be divided into three areas:

1. Existing electricity at schools slated for LCCDs;

2. The charging aspects of the LCCD itself; and

3. On-going electrical costs.

If electricity does not exist at the school, the cost of providing some type of power to recharge LCCDs needs to be factored into the project costs. The type of power option will depend on whether the school is close to the electrical grid. If so, then the cost of connecting the school to the electrical grid must be contemplated. If not, then off-grid options need to be explored.

One solution would be to use a generator, typically powered by diesel fuel. This can be a costly proposition, because it requires purchase of a generator, payment for the diesel and an on-going supply of fuel.

Another option is solar or wind power. Both involve hardware costs, but there are no recurring electricity or fuel costs. In Uganda, for example, a project run by an NGO has been using solar power to recharge LCCD batteries.

The type of LCCD selected has an impact on power needs since some have self-charging options, such as solar panels or hand cranks. There may not be an immediate need for electricity, but the scope of any program will be limited without having a reliable energy source. Networking options inevitably would be constrained, because there would be no power to run a server.

If a school does not have electricity, some households may have power at home, so the LCCDs could be taken home and recharged. The battery power of the device itself varies among brands, as do the charging options. The figure below illustrates a variety of different options for charging the battery. One consideration is a charger and plug. Although most, if not all, LCCDs supply dual voltage chargers, plugs can be problematic, because they vary widely from country to country. This was an issue in the...
Solomon Islands where the plugs that came with the laptops did not match the outlets used in that country.

Figure 3-2: Power options for LCCDs

Since its initial introduction, OLPC’s xo-1 has been modified to successfully re-charge through the use of a hand crank, while the planned xo-3 tablet can be charged via hand crank, solar panel, or even a bicycle or waterwheel fitted with the appropriate connection. 102

Another consideration with respect to electricity is employing LCCDs with low power consumption. For example, the I-slate being developed in India is intended to minimize power consumption, including through the use of a low-power processor. 103


### 3.2 Software

*Software* refers to the LCCD’s operating system and applications, as well as to the educational content delivered to the LCCD.

#### 3.2.1 Applications

*Applications* refer to programs such as word processors, spreadsheets, databases and Internet browsers, as well as applications that also include content such as exercises or other learning tools. Basic applications are not necessarily a significant cost item depending on: (i) the type of LCCD; (ii) the operating system; and (iii) software applications desired.

All low-cost computing devices come with some application software along with the operating system. One consideration is whether commercial software such as the Microsoft Office suite of applications is necessary. If so, this software will need to be purchased; however, software manufacturers often give significant discounts for educational use of their software in many countries. 104

Many software applications are available at no cost. For example, popular Internet browsers (*e.g.*, Firefox, Chrome, and Opera) are free and run on different operating systems. Likewise, the Adobe Reader document reader is also a free download and runs on various operating systems. The *OpenOffice* suite can be downloaded for free and includes word processing, spreadsheet, presentation, graphic and database software. 105 It is available in various languages, runs on a number of operating systems (*e.g.*, Windows, Linux) and can read and write files from other common office software packages.
In some countries, LCCDs must be usable with open-source software, because of the high cost of commercial applications. There is also a philosophical argument that commercial applications are not really necessary for primary school children:

“Children—especially young children—need the opportunity to learn far more than Word Excel, and Powerpoint. Of course, picking up these skills, having grown up with a laptop, will be readily accomplished.”

Applications specifically intended for LCCDs continue to proliferate. The OLPC xo-1 runs a Linux-based operating system called Sugar that was initially developed for OLPC products. Sugar has since been made available for other devices, including those running Windows, MacOS and Linux. Programs that can be used in the Sugar platform currently number nearly 450, including content related to math and science, media creation, games, maps and geography, search and discovery, games and teacher tools, among others. The planned xo-3 tablet will run Sugar or Android, providing access to applications developed for those operating systems.

So, smartphones and tablets running widely adopted operating systems, such as Android or iOS, have increasingly been considered or deployed as LCCDs in educational settings. Such devices can take advantage of a variety of applications – both free and paid – that provide educational content or utility. The use of tablets in educational settings is still an emerging trend, but as such deployments expand, the variety of available applications is also likely to grow. Major device vendors already have made efforts to develop education-focused applications for tablet devices.

For example, in June 2012, Apple agreed to make iPads available to 600 students in 20 Thai schools. Apple also will develop education applications for marketing in its App Store. Intel, in conjunction with its Classmate and Studybook devices, has developed its Learning Series Software Suite, which includes tools for classroom management, note-taking, e-reading, and painting/drawing, among others. The I-Slate being developed for the Indian market runs a custom-developed operating system specifically intended for use in educational settings.

In addition, feature phones can be used as educational and literacy tools. Worldreader, which has conducted pilot projects involving e-readers in Africa, has also developed an application (in conjunction with an Australian application developer) that runs on any Java-enabled handset and provides access to approximately 500 public domain books, as well as contemporary fiction and non-fiction from a
number of developing markets. The Worldreader app is also available for smartphones running Android or BlackBerry OS.


http://www.openoffice.org/


See http://sugarlabs.org/.


### 3.2.2 Content

The term *content* covers the educational materials developed for use on computers and other LCCDs. Content will have to be developed that is specific to the educational system of each country. Development costs vary, depending on:
• The complexity of the content that needs to be created;
• Whether content already exists that can be modified for the LCCD that is being distributed;
• Whether content from other sources can be utilized;
• Whether the languages used in the country are specific to that country, or whether developers can draw on content developed in countries where the same language is spoken; and
• How much of the content development is done “in-house” and how much is contracted to third parties.

One of the consequences of conducting technology trials, or starting pilot projects, is that content development will initially consume a larger portion of up-front costs. In Haiti, for example, the development of Creole language content accounts for 2.6 per cent of total pilot project costs. But this content can continue to be used if the pilot is scaled-up to a full program, so the total cost will be lower over time.

The availability of free content can help to alleviate these costs. The One Laptop Per Child (OLPC) effort works with “Wikieducator,” a site for open sharing of curricular materials. In the Solomon Islands OLPC pilot, primary schools are using free biology lessons downloaded from the Wikieducator site.\footnote{http://wiki.laptop.org/images/c/ca/Solomons_O LPC_Deployment_Report_Aug08.pdf} The pilot project was also able to draw on content developed for an earlier distance-learning project covering teacher training in local languages, as well as agricultural content on beekeeping, turtle conservation and chicken farming.

Worldreader, which has conducted pilot projects that provide e-readers to African schoolchildren, has worked with local publishers in Ghana to digitize local content. The goal is to give students content that may be more culturally relevant and engaging than the Western books that comprise the vast majority of digitized content.\footnote{http://wiki.laptop.org/images/c/ca/Solomons_O LPC_Deployment_Report_Aug08.pdf}

LCCDs that have Internet connectivity also have access to a wealth of free educational information online. For example, the Massachusetts Institute of Technology (MIT) offers MIT OpenCourseWare (MIT OCW), which it describes as “a web-based publication of virtually all MIT course content.”\footnote{http://wiki.laptop.org/images/c/ca/Solomons_O LPC_Deployment_Report_Aug08.pdf} The Khan Academy offers approximately 3,400 online videos with instruction in mathematics, science, computer science, finance and economics, and humanities, as well as standardized test preparation.
3.2.3 Adaptive technologies

As smartphones and tablets have proliferated, there has been increasing development of software intended to assist those with disabilities. Such software is not necessarily targeted at the academic sector, and it may even be included as a core operating system feature. For example, smartphones running current versions of iOS or Android have voice recognition and text-to-speech capabilities, which can be enhanced by third-party applications.

Other functionalities, such as magnification and more advanced speech recognition, can be easily installed as third-party applications on smartphones and tablets running the major mobile operating systems (including Android, BlackBerry, iOS, Symbian and Windows Phone). For example, the Mobile Accessibility suite (for Android) provides replacements for several components of the basic operating system with versions that were specifically designed for people with visual impairments; it also includes a screen reader. \(^{117}\) ClearCaptions (for Android and iOS) provides near-real-time captions of telephone calls on smartphones (as well as computers). \(^{118}\) Nuance offers applications for Android, iOS, and Blackberry that enable search, dictation, email and simplified text entry. \(^{119}\) Other applications make use of mobile device cameras to read barcodes and identify objects and colors. As with any hardware or design feature that benefits disabled users, all of these features can be used by students with disabilities to help them access educational materials.

In addition, there is a growing body of mobile applications designed specifically to assist students with disabilities in a classroom or educational setting. For example, the ITU and G3ict identified several applications for Android and iOS devices that are geared toward students with developmental disabilities and speech therapy requirements, including tools intended to assist with such skills as sharing, letter recognition, conversation skills and sentence building. \(^{120}\)
Governments have encountered certain obstacles, however, in modifying LCCDs for use by disabled persons. In Russia and Uruguay, the governments were unable to install the accessibility applications on their low-cost computers because of hardware limitations, so they instead had to use regular computers. Uruguay also plans to provide adapted computers for deaf and physically challenged children; however, the cost of the adaptive software is expected to be more than the price of the computers (USD 150).


122 http://www.presidencia.gub.uy/_Web/noticias/2009/05/2009050509.htm

3.3 Training

Teachers and students require training on how to use LCCDs. Beyond that, teachers will need to understand how to use LCCDs in the classroom environment and incorporate them into their teaching methods.

Training in basic maintenance and repair may also be necessary in order to keep LCCDs operational. Some LCCD projects have an extensive support system of volunteers that can help defray training.
costs. Techniques such as “training the trainers,” where initial teachers or students are formally trained and they pass on what they learned to others, can also help to lower costs.

Training costs can also be internalized and incorporated into existing training frameworks. ICT learning is also different in that there is a significant amount of free training material provided with LCCDs or available online. Once initial skills have been taught, further advancement often depends on self-initiative and making use of the large amount of free training materials.

3.3.1 Teachers

Teacher training involves a number of steps, which are generally sequenced. The initial group to receive LCCDs requires training in integrating the LCCD in the classroom environment and routine trouble-shooting and maintenance. Those teachers, in turn, generally pass their experience on to the next group to receive LCCDs.

The LCCD project plan for Paraguay, for example, illustrates how the “training the trainers” scheme is used. Four consultants were hired to train 20 teacher trainers who in turn will train the 146 teachers from the participating schools. 123

Training programs and materials continue to evolve, with vendors and sponsors increasingly integrating training with their marketing and outreach efforts. Intel, for example, offers face-to-face, online and hybrid options to train educators on the use of technology in the classroom, among other topics. 124 Intel’s resources are offered in 24 languages, and through partnerships with government ministries and teacher education institutions, the company has reached more than 9 million teachers in 60 countries since 1999. In addition, Intel offers “Teacher PC” reference designs that are meant to meet teachers’ needs, including access to content, professional development and digital literacy resources. 125 On a much smaller scale -- but tightly integrated with its pilot projects -- Worldreader provides training materials for project managers and teachers, including material on how to train students and, if appropriate, how to introduce the project to the larger community.


3.3.2 Students

Student training is typically not a cost item since it is part of the educational process. In other words, students learn how to use the LCCDs in the classroom, just as they would learn mathematics or science. Training to use LCCDs is not a primary goal, but rather a tool to enhance or reinforce other subject matter.

While student training may not be broken out as a cost item, students still must be educated on how to use the LCCDs available to them. The amount of training necessary will depend on a number of factors, including the LCCDs available, how familiar teachers and students are with the LCCDs and their capabilities, and the expected uses of the devices in the classroom.

3.4 Sustainability

Sustainability costs revolve around elements for maintaining and monitoring the LCCD program. This includes equipment maintenance, repair, replacement and disposal, as well as monitoring and evaluating the impact of the project.

3.4.1 Maintenance

LCCDs and other supporting equipment, such as servers and networking components, may require maintenance and repair. In addition, support staff—including new personnel to be hired or contracted—need to receive LCCD maintenance training.

One way of managing maintenance and support costs is to introduce a tiered system. This involves providing adequate training at the local level, where the LCCDs are installed, to handle routine software and hardware fixes. This ensures that basic repairs can be made without having to send the equipment somewhere else, avoiding long periods when students have no access to their LCCDs. A more sophisticated level of maintenance and repair can then be provided at regional or national levels.
for more serious problems. One aspect of tablets and e-readers is that they are generally self-contained devices with few, if any, user-serviceable components. Thus, they should result in a reduced maintenance burden compared with laptop or desktop computers. If they are damaged or fail, though, it may be more difficult to repair them.

Maintenance costs depend on how the program is designed. Costs can be internalized if existing students and staff are trained in basic repair and maintenance and in turn, pass their knowledge on to others (“training the trainers”). Specialized staff will require training for more sophisticated repair activities.

In some cases, maintenance and repair support has been included as part of the bidding requirements for government tenders. Project administrators should obtain performance guarantees and equipment warranties from vendors whenever possible. They should also scope out the logistics for getting LCCDs repaired or replaced.

Any LCCD program should also maintain a stock of new components and replacement LCCDs. In the case of Haiti, for example, 5 per cent of project costs were set aside for replacement stock-piling.

### 3.4.2 Mobile access costs and m-learning

The cost of access and data packages, as well as insufficient connectivity or coverage, are the biggest factors limiting the growth and adoption of m-learning. 126 The high price of handsets (particularly smartphones) and service packages can limit access to m-learning tools and services. Although mobile service costs continue to decline – decreasing 22 per cent between 2008 and 2010 in the developing world, and 19.1 percent in the developed world 127 – service prices remain an obstacle to higher adoption rates.

There are both public-sector and private-sector approaches that can be employed to lower affordability barriers. For example, governments could subsidize or otherwise contribute funding to increase the accessibility of devices and/or services when used for educational purposes. Such initiatives could be driven by ministries responsible for education and ICTs, among others. In the private sector, businesses can work to build business cases for providing devices, services or both for mobile learners.
For example, operators could partner with educational institutions to offer discounted or tailored service plans targeted at students and educators. A 2012 McKinsey & Co./GSMA report estimated that educational connectivity revenue alone would total USD 4 billion globally in 2020. Operators can also partner with other service providers in the education sector to offer product/service bundles and business-to-business offerings.

In addition, efforts to lower device costs in the developing world could have a positive impact on adoption of devices capable of delivering educational content. While smartphones powered by the Android, BlackBerry, iOS and Windows operating systems may garner much attention in the developed world, there also are efforts under way to develop lower-cost smartphones that would be more affordable in the developing world. For example, the Mozilla Foundation – the organization best known for the Firefox web browser – is developing a mobile operating system for smartphones intended for release in 2013. Mozilla and its partners, which include Telefónica, Deutsche Telekom and Qualcomm, aim to make smartphones using the Firefox OS available in Latin America at a price between USD 100 and USD 115. Mozilla is working with other operator partners in regions around the world to develop and deploy such low-cost smartphones.

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3.4.3 Recycling

Policies must be established for the environmentally sound disposal of LCCDs and other equipment. The movement to distribute LCCDs in schools is a relatively recent phenomenon, so experience in this area is still evolving. Furthermore, many LCCDs have yet to reach the end of their lifetimes, with some of the earliest just beginning to reach the end of their expected usable lives. For example, the estimated lifetime of the xo-1 is five years. One step governments could take is to raise this issue with vendors and see if they would be willing to recycle the equipment.

130 http://wiki.laptop.org/go/XO

3.4.4 Monitoring

The purpose of most pilots is to test the suitability of a particular LCCD for the learning environment. So it is vital to establish a monitoring and evaluation process. This involves testing students prior to the introduction of the devices, and then later evaluating the impact of the devices on the students’ learning. The evaluation should also include testing the suitability of the LCCD, as well as the utility of the supporting infrastructure and environment.

Costs for evaluation might include the monetary compensation for personnel to carry out the evaluation, as well as the development of “before” and “after” tests. Monitoring and evaluation costs vary by country, depending on the detail and complexity of the evaluation. In Haiti, 3.9 per cent of project costs were set aside for monitoring and evaluating the project. Part of the evaluation in Haiti was based on a standardized test administered by UNESCO throughout Latin America and the Caribbean.

3.5 Managing costs effectively

LCCD programs have significant costs, and successful management of those costs is critical to the process of generating funding. One decision is whether the national government should adopt a national plan to minimize cost elements through economies of scale or whether local school administrations should adopt their own plans.
The scope of the project informs this decision. If the LCCD initiative is still in a pilot phase, then procurement may not require centralized intervention. Indeed, most pilots are small-scale efforts, often largely financed through development assistance and donations from equipment vendors. Therefore, they do not require a significant initial outlay from the government. Furthermore, local administrations might be better placed to form partnerships and more able to get the project off the ground quickly.

A large-scale implementation through the government’s education ministry, however, can aggregate purchases to achieve lower costs. The national government is also more likely to have procurement expertise and the capability to evaluate rival offers. One method of selection is to use a tender process, in which the project’s requirements are laid out in detail. In Brazil, for example, a tender process was integrated into the country’s “e-procurement” system.

4 Implementing a sustainable LCCD programme

This section of the toolkit identifies elements necessary to achieve a sustainable low-cost computing device (LCCD) programme.

4.1 Project coordination

The implementation of an LCCD programme is a complex undertaking. LCCDs can have significant impacts on classrooms, teachers, training methods, distribution of educational materials and curriculum. They can also affect school funding and infrastructure requirements (e.g., electricity and networking). Given the complexity of such programs, many countries have chosen to implement LCCD projects with various partners.

The decision to implement an LCCD programme is sometimes made at the highest level of government. If the government changes, then there may no longer be support for the program. This was the case in Ghana and Nigeria, where new governments stopped LCCD programmes. One way to avoid this is to create a national coordinating committee, which adds legitimacy and sustainability to the project.
Once the decision is made to implement a low-cost computing device programme, it is generally coordinated through the ministry responsible for education. Furthermore, partners often insist on some kind of commitment from the education ministry before they will participate.

Although the education ministry may take overall responsibility for the programme, ongoing management is sometimes delegated to a technical branch of the ministry or agency of the government. In Uruguay, the Technological Laboratory of Uruguay (Laboratorio Tecnológico del Uruguay or LATU), a quasi-autonomous organization, coordinates the country’s LCCD program. LATU is managed by a board of directors overseen by a government representative (from the Ministry of Industry, Energy and Mining), a representative from the Chamber of Industry, and a delegate from the central bank.

In Haiti, the Ministry of Education and Vocational Training (MENFP) is responsible for overall LCCD coordination. It chairs the ICT in Education Steering Committee, which consists of both public and private sector representatives that oversee the project. The pilot is implemented by the Project Coordinating Unit (PCU), located within the MENFP.

In Nepal, the LCCD project is coordinated by the Department of Education, with input from the Ministry of Education and Sports, the Curriculum Development Center and the National Center for Educational Development. Participants also include NGOs and international partners such as Danish development assistance (see figure below). School administrators, teachers and parents are also part of the implementation process. The Open Learning Exchange (OLE), a Nepalese NGO, has an agreement with the government of Nepal to help implement the project. Table 7-1 provides a list of project responsibilities among different partners.

Figure 4-1: LCCD project coordination and partners in Nepal
Coordination across government and the private sector is a key factor in the success of m-learning programmes. The following sections describe the roles and responsibilities of different players.

### 4.1.1 Role of the ICT minister

The minister responsible for ICTs can play a key role in enabling an environment conducive to the introduction and success of m-learning initiatives. Specific approaches will, of course, need to be tailored to a country’s particular circumstances. Among the tools available to the ICT minister are:
• Adopting and adapting related legislation: The ICT minister can, working within the legislative process, ensure that there is an enabling environment for the use of ICTs to deliver m-learning services to students and others. Such legislative efforts could address several factors, including decisions regarding service licences and conditions, universal access/universal service plans, and protection of children from online threats.

• Coordination: The ICT minister can and should coordinate with other government entities – notably the education ministry – to ensure a coordinated approach to supporting m-learning initiatives.

• Outreach: The ICT minister is likely responsible for national efforts to monitor and promote safe and productive use of mobile and online services. This can include spearheading campaigns intended to promote awareness of m-learning services and initiatives, as well as ensuring that such outreach is aimed at appropriate audiences.

• Online/mobile protection: The ICT minister is generally well-positioned to drive and encourage local industry initiatives to protect young people using mobile and online services from fraud, predators, and other threats.

4.1.2 The role of mobile operators and the private sector

Mobile operators serve a vital role in the provision of m-learning services by providing the connectivity that underpins such services. However, operators can take additional actions to further support increased access to educational content. For example, operators can offer discounted service fees for schools and educational institutions, or discounts for calling, SMS messages or data downloads of educational resources. Operators can also offer their expertise or network resources to assist in content aggregation and storage. Such resources can include webinars, podcasts, text recaps of lessons and educational video games.¹³¹

By developing or improving their managed services capabilities to cater to the m-learning market, operators can enable the development of robust mobile education platforms. In addition, operators can take steps to ensure that students and other young users are protected from malicious activity or content – not only by adhering to existing regulations but by offering protections beyond those required by law. Mobile operators also have expertise in areas that could support and strengthen m-learning initiatives, including customer care, technical support, and device management.¹³²
For m-learning to positively affect education in a substantive way, educators and policymakers will need to forge new partnerships with industries and stakeholders that have not historically been involved in education, or whose core competency may lie outside educational fields. For example, Qualcomm partnered with the ministries of education in Jordan and Singapore to bring 3G into the classroom.

The Jordan Education Initiative (JEI) is supporting a pilot project that in the fall of 2011 gave more than 200 students (grades 7-10) and 35 teachers at two schools 3G-enabled netbooks to conduct online research, complete multi-media presentations, and collaborate better. The netbooks have classroom management software allowing teachers to send and receive student assignments. Some teachers are creating their first email accounts and are learning how to communicate with other teachers and students using the Internet. For this project, Qualcomm partnered with JEI, the Jordanian Ministry of Education, and the Ministry of Information Communications Technology.

Singapore’s Ministry of Education promotes a framework for transforming the learning environment for students. To promote self-directed learning and a collaborative learning environment, 350 third-grade students and their teachers at Nan Chiau Primary School were given smartphones. This gave students anytime access to educational content, web-based resources and a broad range of learning tools that support self-directed and collaborative learning. For this project, Qualcomm partnered with Microsoft, the National Institute of Education, Nokia, SingTel, and the University of Michigan.


4.2 Funding

A full-scale one-to-one LCCD program typically exceeds the resources of most developing nations. Consider Nepal, where the government drastically raised the education budget, planning to spend USD 609 million for the 2009/2010 school year. Assuming a price of USD 150 for each LCCD, and with 4.4 million primary students, the cost of providing each Nepalese pupil with an LCCD would be USD 663 million -- exceeding the entire education budget.

In addition, if countries opt for the one-to-one model, they need to realize that this is a long-term commitment since each year there will be a new class of children that require their own new laptops.

Most LCCD programs are conceived as public-private partnerships so that costs can be spread among various parties. In addition, some vendors sponsor initial donations of computers for pilot projects. Somewhat surprisingly, development assistance has yet to be significant in this area despite the educational potential and economic importance of access to ICTs.

4.2.1 Government

Governments usually must cover some funding to demonstrate commitment and sustainability:

The OLPC Association focuses on designing, manufacturing, and distributing laptops to children in lesser-developed countries, initially concentrating on those governments that have made commitments for the funding and program support required to ensure that all of their children own and can effectively use a laptop.
The extent of the government’s financial support will depend on the scope of the program. A pilot project in a few schools will not entail significant government resources, whereas a full-scale national implementation would call for a government funding commitment.

In Haiti, the government is only financing USD 100,000 or 2 per cent of a pilot LCCD program, with the balance coming from the Inter-American Development Bank and the OLPC Foundation. A key government decision will be how much it can internalize costs by absorbing the resources required for a LCCD program into existing processes. This will require prioritization of educational goals to show commitment to LCCDs and one-to-one computing.

Some governments have made a serious commitment to LCCD for schools by providing significant funding. A few middle-income countries are largely funding LCCDs from their own education budgets. In the case of Uruguay, the government allocated 497 million Uruguayan pesos (USD 21 million) to its LCCD program in 2007, almost 3 per cent of its education budget. The Uruguayan government has attracted other partners to the program to help defray costs. This includes the incumbent telecommunication operator, which is providing Internet access. Meanwhile, a group of volunteer students has been set up to provide computer training.

In Brazil, the federal government funds equipment, Internet access, training and assessment, while state and municipal governments are expected to provide the necessary school infrastructure (e.g., electricity) and logistical support, and to forge partnerships with other stakeholders and potential funding sources.

In addition, the United States Agency for International Development (USAID) provides funding for the Mobiles for Education Alliance, which is “is committed to reducing barriers to access appropriate, scalable, and low-cost mobile technologies to help improve learning outcomes in formal and non-formal education across all levels, especially in low-resource and developing country contexts.” 138 Alliance members include organizations in Germany, the United Kingdom and the United States, as well as the World Bank, the Inter-American Development Bank, UNICEF and UNESCO, among others.


4.2.3 Non-governmental organizations (NGOs)

Non-governmental organizations (NGOs) are also supporting various LCCD programs. The Internet Society, for example, has provided funding to evaluate the LCCD project in the Solomon Islands. \(^{143}\) In one of the world’s largest non-governmental LCCD programs, the Volnoe Delo Educational Foundation is providing funding for implementing LCCDs in Russian schools. \(^{144}\) In Uganda, the Maendeleo Foundation operates a Mobile Solar Computer Classroom. A jeep takes Classmate PCs to schools in different villages; the LCCDs are recharged using solar panels mounted on the roof of the jeep. \(^{145}\) Worldreader, an NGO focused on expanding access to books in the developing world, has implemented several projects in sub-Saharan Africa.


\(^{145}\) [http://www.intelchallenge.com/mobilesolar](http://www.intelchallenge.com/mobilesolar)

4.2.4 Development assistance

Some multi-lateral and bi-lateral development agencies are playing a significant role in the LCCD movement. For example, the Inter-American Development Bank (IDB) \(^{146}\) is providing funding support for LCCD pilots in Haiti \(^{147}\) and Paraguay. \(^{148}\) In Uruguay, it has provided assistance for technical support and evaluation of the LCCD program \(^{149}\) and its extension to secondary schools. \(^{150}\) The IDB is also funding evaluation of LCCD pilots in Brazil.
In terms of bi-lateral assistance, the USAID provides assistance for Afghanistan’s LCCD project. USAID also contributed to a Worldreader program in Ghana as a Global Development Alliance project. The Danish government is assisting with funding an LCCD pilot in Nepal.


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

4.2.5 Volunteers

Although volunteers do not usually provide direct funding, they can indirectly help defray training and logistical costs by providing free and often skilled labor. Volunteers have been used in various LCCD projects, particularly to assist with training activities.

In Uruguay, volunteers are organized under the Support Network of the Plan Ceibal (Red De Apoyo al Plan Ceibal or RAP CEIBAL). University students, professionals and retirees from all over the country participate in local groups that offer assistance in areas such as equipment delivery, training children in using the LCCDs, developing learning exercises for students and parents and researching technical issues.
OLPC has an OLPCorps Africa project, whereby 30 college students have been trained to provide technical support for OLPC pilots throughout Africa. After a 10-day orientation course in Rwanda, volunteers were sent in teams of two to different African countries for up to 10 weeks. They were provided with 100 xo-1 laptops for deployment and USD 10,000 to cover costs. OLPC also organized an internship program for college students to work with local personnel in Peru and Uruguay, where they help to implement LCCD programs. 155

154 http://rapceibal.blogspot.com/

155 http://one.laptop.org/action/volunteer#/intern-olpc

4.2.6 Parents

In some countries, parents are required to contribute towards defraying the cost of purchasing the low-cost devices. This can lead to reduced theft and damage, if parents and students assume ownership and responsibility for the equipment they have purchased.

In Rwanda, parents of students in private schools must purchase LCCDs. Arrangements are being made for long-term loans from banks to be repaid by parents of students. 156 Similarly, in Nigeria, parents of students from the private Corona Secondary School have purchased Classmate PCs for their children. 157 In Portugal, the Magellan program charges parents for LCCDs based on their economic situations. Those from low-income households do not have to pay, while medium-income families pay EUR 20 and those with higher incomes pay EUR 50. 158


158 http://en.wikibooks.org/wiki/One-to-One_Laptop_Schools/Portugal A Portuguese mobile operator was also running a contest in early 2009 awarding one Magalhães PC per day for users who had topped-up their prepaid cards. http://web.archive.org/web/20091218084755/ http://www.telecom.pt/InternetResource/PTSite/UK/Canais/Media/DestaquesHP/uzomagalhaes.htm
4.2.7 National policies to promote LCCDs

4.2.7.1 Universal service funds

Universal service funds can be a source of financing in some countries. These funds, generally administered by the nation’s telecommunication regulator, are composed of contributions from operator revenues. They are normally designed to defray the costs of providing telecommunication services in remote or rural areas, or to subsidize services for low-income users. Universal service funds have been used in several countries to finance the acquisition of computers for schools:

- In Colombia, the Computers for Education project draws on the country’s universal service fund to distribute recycled computers to schools.\(^{159}\) More than 14,000 schools have benefited from the project, which has distributed more than 200,000 computers.

- In Morocco, the universal service fund is used to finance the country’s GENIE program, which installs computer labs in schools. In 2006, the program financed the distribution of more than 27,000 computers in more than 1,800 schools, reaching some 1.4 million students.\(^{160}\)

- In Nigeria, a tender was issued in 2009, inviting bids to install 100 PCs in each of 550 secondary schools across the country. The project will be financed by the Universal Service Provision Fund.\(^{161}\)

\(^{159}\) http://www.computadoresparaeducar.gov.co


4.2.7.2 Demand generation

In recent years, some countries have developed policies or plans related to broadband that include demand generation components intended to spur interest in broadband connectivity. Such programmes and policies often include approaches to support improved access to LCCDs. An
important component of such efforts is political support from government ministries that are responsible for education, telecommunications, and human resource development.

For example, as part of legislation addressing universal broadband coverage, the Dominican Republic included financing mechanisms necessary for the acquisition and installation of computers, personal digital assistants (PDAs), smartphones, and other devices that provide access to a broadband connection. Colombia’s plan, Vive Digital, also addresses device cost issues by eliminating customs tariffs and making access to credit for the acquisition of terminals more flexible.  


See http://www.vivedigital.gov.co/.

4.2.8 Student installment plans

One method to help students buy low-cost computers is to let them pay over time, on an installment plan. This makes the computers more affordable and allows the students to begin using them immediately.

Installment programs are generally aimed at secondary and, more often, tertiary-level students. One of the first countries to implement this type of program was France. The Ministry of National Education launched the MIPE (Micro-Portable Étudiant) program in 2004. The effort was undertaken in conjunction with almost all of the country’s universities, as well as with private partnerships involving computer vendors and banks. MIPE offers university students an opportunity to purchase a laptop with Wi-Fi capability and pay for it in installments. The payments are spread out over three years -- roughly the equivalent of paying EUR 1 per day -- and the universities have agreed to provide free Wi-Fi access.
More recently, the Portuguese government has worked with mobile operators to give secondary students laptops, bundled with mobile broadband subscriptions (see the Portugal Case Study). In Namibia, mobile operator MTC offers university students a laptop for NAD 3,999 with a discount on monthly mobile broadband Internet access.  

4.2.9 Donations

Contributions of money or used computers can help defray expenses. Used computer donations are a key component of recycled computer programs, and they can play a part in projects to spread computers to schools in developing countries. Computer Aid International accepts donations from both businesses and individuals.  

One example of a national program is Colombian Computers for Education, which accepts used computers from companies, the public sector and individuals. OLPC accepts cash donations that are then used to purchase a laptop for a child in a developing country.  


http://www.atelier.fr/statistiques/10/30112004/operation--pc-1-euro-jour--40000-unites-vendues-28720-.html  

http://connected.mtc.com.na/  

http://www.computeraid.org/  


4.3 Distribution

Under the one-to-one LCCD philosophy, each child has his or her own device. In practice, however, this may be difficult for most developing nations to achieve, given the enormous expense of outfitting each child with a device -- particularly in countries with large populations of children.

Although one-to-one computing may be a long-term strategy, in the short term, governments may have to make choices about which schools and which students should benefit immediately from LCCDs, and which populations will have to wait. One of the first distribution choices is deciding which grades should benefit from the program. Many programs and most LCCD features are aimed at primary schools, but there have also been implementations in secondary and even tertiary-level institutions.

4.3.1 Pilot projects

One approach may be to establish initial pilot projects in different school environments. In a monitored environment, authorities can then test how LCCDs will be used in those different school situations. They can compare LCCD pilots in urban and rural settings, with public and private schools, and with younger and older students.

This was the approach taken in Haiti where a representative sample of different school environments was selected. Determining a representative sample size will determine the number of LCCDs that will be needed for a pilot to ensure a scientifically accurate evaluation across a range of school environments.

“A preliminary sampling matrix has been identified to capture the following school characteristics: urban, rural, public, non-public, multi-grade and single-teacher schools. To accommodate these variables, allowing for variation in results the sample should contain a minimum of 13,200 beneficiaries. The TC will finance the further elaboration of this matrix, from which an estimated 60 public and non-public primary schools in three departments will be selected for the pilot. All beneficiary schools will belong to existing school networks structured around Basic Education Pedagogical Support Centers (EFACAP). Implementation of the pilot will be sequenced, allowing for ongoing evaluation and comparison between groups of schools receiving the XO laptops at the beginning and at the end of the
4.3.2 Saturation

Another distribution strategy is saturation. This involves selecting a small number of schools, but then providing LCCDs to all students, in all grades, in those schools. The benefit of this approach is that the pilot can be tested across a range of grades in one environment. Also, this often requires fewer LCCDs and minimizes resentment among children that might arise if some students have LCCDs and others do not. 171

One way of achieving saturation with a wider school distribution is through sharing the LCCDs, particularly where schools are operated in shifts. For example, this was done in a few areas of Brazil. One drawback is that students cannot take the LCCDs home to share with parents. This can be an issue where the intent is to implicitly raise household computer and Internet connectivity by having parents and siblings use the devices. It may also be a problem if school administrators are counting on students to recharge the LCCDs’ batteries at home.

Another factor influencing the distribution for testing would be school and community acceptance. In Afghanistan this was one of the reasons cited for the selection of the first pilot school:

“The parent's attitude, community acceptance, [and the] teacher's and school's representative overall attitude towards OLPC were the major factors for selection. Also the school size and the number of students in that school was the best match for our first pilot school.” 172

171 Schools in the Solomon Islands requested that they be saturated in the next phase of trials but the education ministry decided that evaluating the impact across different provinces was more important:

“That the Ministry consider allocating 250 laptops from the next batch of laptops to complete (saturate) all grades in each of the three trials sites before expanding to other schools and provinces. This is to ensure that each whole school participates in the trials, providing more data for evaluation and allowing all teachers to collaborate and develop teaching ideas. The 75 initial laptops would be used for grade one at the three Marovo schools, and the Ministry would consider whether to use additional laptops via SPC for completing these schools or to expand single-class trials to other provinces. Laptops were
distributed to Batuna and Patukae schools for all the grade one students and teachers, plus a few for key teachers in neighbouring secondary and vocational schools, fitting with the Ministry’s requirement to evaluate impacts in each sub-sector.”


172 http://wiki.laptop.org/go/OLPC_Afghanistan/Deployment_News

4.3.3 Electricity

The goal of many LCCD programs is to provide computers in rural areas. The main factor affecting this is the availability of electricity. For example, Brazil’s ProInfo project established specific pre-qualification criteria for schools interested in obtaining computers. One of those prerequisites was the existence of electricity (see table below). Governments can install electricity in rural areas that are targeted for LCCD programs. However, the costs can be high, particularly if the area is a long distance from the electricity grid. Other options include providing stand-alone solutions, such as diesel-powered generators or solar energy. Another consideration for areas with a lack of electricity is the type of LCCD selected. Some offer a number of off-grid and human-powered solutions for charging the battery.

Table 4-1: School Selection Criteria for Brazilian ProInfo Project

<table>
<thead>
<tr>
<th></th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of school</td>
<td>Elementary</td>
<td>Elementary</td>
</tr>
<tr>
<td>Number of students</td>
<td>&gt;50</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Electricity</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Informatic lab</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
4.3.4 Distribution timetable

If the decision is taken to scale-up the program to incorporate the whole country, a timetable will be needed, since not all the devices can be distributed simultaneously. In Uruguay, LCCDs were distributed:

- First, to a pilot school in one province,
- Second, to all the schools in the same province, then
- Third, to all schools nationwide except for the capital, and finally
- Fourth, to the capital (see figure below).

The process will take approximately three years, but it will ensure that less-privileged schools outside the capital receive LCCDs first. In Brazil, the current phase of the LCCD program calls for distributing 150,000 LCCDs to 10 schools in each of its 27 provinces as well as five municipalities.

Figure 4-2: Sequencing LCCD Distribution in Uruguay

Note: Departments are the top level administrative unit in Uruguay, equivalent to a province or state. There are 19 departments in Uruguay.

Source: Plan Ceibal.

Another concern might be to prevent LCCDs from being distributed only to the most privileged elements of the population. Most of the trials and deployments to date, however, have adopted a conscious policy of distributing to public (rather than private) schools, generally outside urban areas. In order to avoid allegations of favoritism or corruption, the rationale and plan for LCCD distribution should be documented and made publicly available.
4.3.5 Gender issues

Explicit discrimination regarding gender has not been a significant issue in the on-going LCCD trials and implementations around the world.

The concept of one-to-one computing is inherently more equitable than a shared environment, in which some students could come to dominate access to the limited number of computers. Problems with equitable distribution are more likely to arise as a result of the existing socio-cultural environment in a country. For example, if schools are not integrated by gender, then there is more scope for a lack of transparency in LCCD distribution. In Afghanistan, where many primary schools are separated by gender, LCCDs were distributed to a girls’ school and a “mixed” school in Kabul. In the mixed school, girls study in the morning and boys in the afternoon. 173

LCCDs also have the potential to become devices for empowering and training mothers, if students are allowed to bring them home. OLPC has found this has a great influence on the entire family. Children often teach computer skills to their mothers and even grandmothers. For this reason, OLPC often insists that governments let children take the LCCDs home.


5 National case studies

The following national case studies illustrate various aspects of the cost, coordination, logistical and management issues associated with implementing and sustaining a program to provide or support low-cost computing devices in schools.

5.1 Afghanistan

In September 2008, the Ministry of Education (MoE) and Ministry of Communication and Information Technology (MoCIT) launched an OLPC pilot in Afghanistan. 174 The project is a public-private partnership with the United States Agency for International Development (USAID), the Afghan mobile operator Roshan, and Paiwastoon, a local information technology company.
Each partner has a specific role in the project. The MoE and MoCIT are the government institutions tasked with improving education and the information technology (IT) sectors. Their collective goals are to embed communications technology into the education sector and to establish platforms to transform Afghanistan into an information society. To achieve this, MoE distributes the LCCDs to schools, along with digitized textbook content, the Quran and Web content. The MoCIT is responsible for ensuring the quality of the content, as well as the optimal functioning of the technology.

The private companies, Paiwastoon and Roshan, lend support in terms of content, software, training, connectivity, project management and implementation. Paiwastoon develops content in the local Dari and Pashto languages, customizes software and trains teachers. Roshan handles connectivity through its social responsibility program. It also assists in facilitating the OLPC donation for the project and provides management support. In addition to supplying connectivity where it has existing infrastructure, Roshan supports and counsels installation teams responsible for the implementation of networking infrastructure.

USAID, through its small and medium enterprise development project, provides organizational support in connecting these partners to OLPC, as well as financial and logistical support for the creation of online Dari training. Other support products are a localized business creation toolkit and a marketing campaign to promote and expand the program’s implementation as a tool for economic development.

The OLPC Foundation is contributing 5,000 XO laptops to Afghanistan. The OLPC technical implementation team began work in November 2008, preparing and translating teacher training materials into Dari and Pashto and carrying out power tests.

Almost half of the XO laptops have been distributed since the program was initiated. The first deployment of the XO laptops took place on 17 March 2009 to Estiqlal High School in Jalalabad, a city about 150 kilometers east of the capital Kabul. Some 400 laptops were distributed to 4th, 5th and 6th graders at the school. The second deployment of the laptops took place on 21 June 2009 in Kabul. Approximately 2,000 XO laptops were distributed during this phase to four schools in the capital city.

175 http://svr1.paiwastoon.net/
5.2 Brazil

Brazil announced its One Computer per Student (Um Computador por Aluno or UCA) project in 2005. The project is coordinated by the President’s office and implemented by the Ministry of Education. It has also been integrated into the country’s educational development program.

The UCA project is being implemented in several phases, of which the first two have been completed. In the first phase, three types of LCCDs—Intel Classmates, Mobilis Encores and OLPC XOs—were donated by vendors and tested in five different elementary schools (see figure below). The federal and local governments covered other costs. One of the features of these pilots was to explore how the one-to-one model was implemented through sharing. This was possible because in some of the schools, students attend at different times of the day in order to maximize use of the school infrastructure. This allows the same laptops used by students at school in the morning to be used by those attending in the afternoon.

The second phase is a larger-scale implementation of 150,000 LCCDs to 10 elementary schools in each of Brazil’s 27 states, as well as five municipalities. The government issued a tender in December 2007, but it was subsequently cancelled because the government considered the LCCD prices submitted by bidders too high in comparison with prices in other countries. The higher LCCD costs actually stemmed from taxes imposed on LCCDs in Brazil, which added up to 71 per cent (60 per cent for customs duty and 11 per cent for a social tax). These taxes were much higher than in many countries and therefore significantly increased the price of the LCCD. The tender eventually was reissued in 2008, and an Indian-manufactured LCCD, the Mobilis, was the winner. The ultimate outcome of the pilot is unclear, as development of the Mobilis devices appears to have ceased.

Brazil’s local governments are co-funding the project. The federal government is responsible for covering the cost of the LCCDs and local governments are covering the costs of school infrastructure.
(e.g., provision of electricity), as well as the training and content costs. Teacher training is implemented through a network of partners, including universities.

Figure 5-1: Brazil One Computer per Student Phase 1 deployments

- **INTEL CLASSMATE**
  - **Palmas-TO**
    - Colégio Estadual Dom Alano Maire Du Noday
    - Quantity: 400
    - Feature: share in different shifts
  - **Pirai-RJ**
    - CIEP No477 Prof Rosa Conceição Guedes
    - Quantity: 400
    - Feature: 1:1

- **ENCORE MOBILIS**
  - **Brasilia-DF**
    - Centro de Ensino Fundamental No 1 do Planalto
    - Quantity: 40
    - Feature: share in 3 different shifts

- **OLPC XO**
  - **Sao Paulo**
    - Escola Municipal Ens. Fund. Emani Silva Bruno
    - Quantity: 365
    - Feature: share in 3 different shifts
  - **Porto Alegre**
    - Escola Estadual Luciana de Abreu
    - Quantity: 395
    - Feature: 1:1
5.3 Nigeria

In March 2007, the One Laptop Per Child (OLPC) Foundation provided XO laptops for primary school students and teachers in Galadima, a town near the capital Abuja. The public school there had no electricity. As a result, the laptops were removed in December 2007. They were supposed to be replaced with new ones more suitable to the school environment. However, a change in government led to funding cuts and the replacement laptops were never procured.

Meanwhile, the Jabi Secondary School, also near Abuja, is the site of another pilot using Classmate PCs. The pilot is supported by the Ministry of Education and the government of the Federal Capital Territory Authority. Intel has donated 40 computers and provided a full-time IT manager at the school, making it a showcase for Classmates in Africa. The Jabi school has electrical power, as well as a WiMAX Internet connection that reportedly costs USD 10,000 per month. The Internet connectivity is available directly to the laptops (via wireless connection) without using a server.

Nigeria's government has reversed direction several times on technologies and scope of LCCD deployment. It had initially announced its intention to support a large LCCD deployment, but it later scaled back those plans. In terms of operating systems, it has wavered between Windows and Linux.

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182 “The previous government of Nigeria had committed to buying one million laptops.” [http://news.bbc.co.uk/2/hi/technology/7094695.stm](http://news.bbc.co.uk/2/hi/technology/7094695.stm)
5.4 Peru

In May 2007, Peru’s Minister of Education announced the country’s participation in OLPC, stating that every school child would receive a laptop. The goal was to provide all primary school students with a laptop by 2011. By mid-2008, some 40,000 computers had been distributed. Another 100,000 were installed by the end of that year, and there were plans to purchase an additional 150,000 in 2009. With about 4 million primary school students, equipping each one with a LCCD at a cost of USD 150 would amount to approximately USD 600 million, or about 20 per cent of the country’s education budget.

In September 2008, Microsoft reported that Peru would become the first country in the world to have XOs with Windows software installed.

Table 5-1: Education Indicators, Peru, 2007

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of primary school students (000s)</td>
<td>3,947</td>
<td>2,620</td>
<td>1,326</td>
</tr>
<tr>
<td>Number of secondary school students (000s)</td>
<td>2,496</td>
<td>2,097</td>
<td>399</td>
</tr>
<tr>
<td>Percentage of public schools with electricity</td>
<td>48.1</td>
<td>79.7</td>
<td>34.5</td>
</tr>
<tr>
<td>Education budget (USD millions)</td>
<td></td>
<td>3,016</td>
<td></td>
</tr>
<tr>
<td>As % of total government budget</td>
<td></td>
<td>16.7 per cent</td>
<td></td>
</tr>
</tbody>
</table>
As % of GDP | 2.7 per cent

Source: Ministerio de Educación-Unidad de Estadística Educativa.

184 http://one.laptop.org/map/peru
185 http://www.minedu.gob.pe/noticias/index.php?id=6432

5.5 Portugal

Portugal’s e-escola program was announced in June 2007. It calls for distributing 750,000 laptops (ASUS, ACER, Fujitsu, HP, Insys or Toshiba), along with broadband Internet access, to teachers and secondary students.

The laptops include Windows software and sell for EUR 150. Students from low-income households receive the laptop for free, but they have to pay for the broadband service subscription. The laptops are sold through telecommunication operators, which offer an EUR 5 discount off the monthly broadband price, with reduced monthly fees for low income students. The program started in September 2007, and 250,000 laptops had been delivered by June 2008. E-escola is subsidized from the fees mobile operators paid for UMTS (3G) licenses.

Table 5-2: The e-escola Mobile Broadband Offer

<table>
<thead>
<tr>
<th>Income level</th>
<th>1st Scale</th>
<th>2nd Scale</th>
<th>3rd Scale</th>
</tr>
</thead>
</table>

CONNECT A SCHOOL, CONNECT A COMMUNITY connectaschool.org
<table>
<thead>
<tr>
<th>Laptop</th>
<th>€0</th>
<th>€0</th>
<th>€150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Internet price</td>
<td>€5</td>
<td>€15</td>
<td>€17.87</td>
</tr>
</tbody>
</table>

Note: Income level refers to the Portuguese system whereby households from 1\textsuperscript{st} and 2\textsuperscript{nd} scale are eligible for various government education subsidies. The broadband offer requires a 36-month commitment. The plan is capped at 1GB data transfer per month and offers speeds up to 2 Mbps. For the 3\textsuperscript{rd} income level, the laptop is not bundled into a monthly price, requiring users to purchase it upfront.

Source: TMN.

Building on the e-escola experience, the Portuguese government in July 2008 formed a partnership with Intel to produce a Portuguese version of the Intel Classmate (the “Magalhães”). The e-escolinha project calls for distributing this computer to 500,000 primary school students. The program charges parents a fee for the computer, based on their economic situation. Those from low-income households do not have to pay, whereas those from medium-income households pay EUR 20 and those from upper-income homes pay EUR 50. Some 370,000 Magalhães computers have been distributed. After a student has obtained a laptop through the program, Portuguese mobile operators offer an optional EUR 5 per month discount for broadband Internet access.

188 [http://www.tmn.pt/portal/site/tmn/menuitem.0143d3546741f79ae8f48210751056a0/?vgnextoid=8823eb8b16c23110VgnVCM1000005401650aRCRD](http://www.tmn.pt/portal/site/tmn/menuitem.0143d3546741f79ae8f48210751056a0/?vgnextoid=8823eb8b16c23110VgnVCM1000005401650aRCRD)


190 [http://en.wikibooks.org/wiki/One-to-One_Laptop_Schools/Portugal](http://en.wikibooks.org/wiki/One-to-One_Laptop_Schools/Portugal)

5.6 Rwanda

ICT development is a main, cross-cutting issue in Rwanda’s Vision 2020, the country’s framework for economic and social development and conversion to a knowledge-based economy. Given the prominence of ICTs in Rwanda’s development strategy, it is no surprise that its President, Paul Kagame, is a supporter of low-cost computing devices. Kagame is also a personal friend of Nicholas Negroponte, the developer of the One Laptop Per Child (OLPC) initiative.

Rwanda launched its OLPC programme in October 2008, with three schools receiving 5,000 laptops. Another 10,000 laptops were distributed in 2009 to schools in five districts (Gasabo, Kicukiro, Nyarugenge, Rwamagana and Rusizi). The programme in Rwanda called for an additional 100,000 XO laptops to be provided to at least half the primary schools in the country by 2012.  

Rwanda aims to be a major player in the OLPC movement. In June 2009, Rwanda established the headquarters for the Global Center for Excellence in Laptops and Learning, which is located in the Kigali Institute of Science and Technology (KIST). Another initiative is dubbed “OLPCorps.” It invites university students from around the world come to Rwanda for training. OLPCorps then deploys the trainees different African countries to support the OLPC projects in those nations.

5.8 Kenya

Worldreader is a U.S. and European non-profit whose mission is to make digital books available to children in the developing world. It has undertaken projects in several African nations using e-readers. As of June 2012, the organization’s projects have distributed more than 220,000 digital books to 1,000 children in sub-Saharan Africa. Worldreader works with sponsoring organizations to close the gap between the cost of e-readers and books and the prices local communities can pay. The organization also develops and digitizes local and international books, as well as managing logistics and support operations. It works in partnership with local governments, school systems, and related businesses. Further, Worldreader provides technical and pedagogical training for project managers and local teachers, as well as helping local businesses repair e-readers.

In 2011, Worldreader and The Kilgoris Project partnered to launch the first classroom e-reader project in East Africa. The project was conducted at Ntimigom School in Kilgoris, the capital of the Trans Mara region of Kenya. It provided a total of 3,150 books, as well as capacity-building training, using Amazon Kindle e-readers. Ntimigom School’s four nursery-level teachers and three primary-level teachers serve more than 200 students in the Trans Mara region. The school is a sponsored public school, with funding coming from Kenya’s Ministry of Education and The Kilgoris Project.

This project was intended to provide a foundation for future efforts with schools and organizations all over the world. The two organizations shared two primary goals for the Ntimigom project:

1. **Access to books:** To increase the quality of education available to the Ntimigom students by providing access to a world of books. The organizations felt that increased access to books would broaden the way students thought and help to develop their creativity.

2. **Capacity building:** To use e-readers and teacher training as tools for teacher motivation, including for personal development, keeping abreast of educational research, or as resources for lesson planning.

The project began with a feasibility study conducted by Worldreader in January 2011. Worldreader sought to assess the school’s environment and content needs, as well as meeting with representatives...
from The Kilgoris Project, the school and the community. That study led to a formal cooperation agreement between Worldreader and The Kilgoris Project.

A detailed implementation plan was developed for project execution. The plan included the following phases:

- **Device set-up and transportation** – This included shipping, labeling, and configuration of the e-readers, as well as inserting them into cases. Device set-up was carried out by representatives of Worldreader, The Kilgoris Project and Ntimigom School in space provided by a local start-up incubator.

- **Content selection and distribution** – Worldreader signed partnership agreements with two Kenyan publishers, allowing the organization to digitize selected books and make them available to students at no cost. The project also was able to add content from Ghanaian publishing partners, international publishing partners, and the public domain. Each of the 51 student devices was initially provisioned with 42 e-book titles, and each of the 14 teacher devices was provisioned with 72 titles. Plans were laid for future content provisioning, and training was conducted for teachers, the project coordinator, and students. The training was conducted as follows:
  - **Teacher training** – Eight three-hour modules, conducted over two weeks, addressed basic and advanced technical skills by utilizing leisure reading, mock sessions with actual students, book reports and reading incentives, lesson plans and e-reader keywords.
  - **Project coordinator training** – The Ntimigom School principal was trained as the project coordinator, with skills such as how to delete and retrieve a book from the archive, inventory management, registration and deregistration.
  - **Student training** – Teachers (with coaching support) provided training to students on basic technical skills related to the e-readers.

- **Reading assessment** – Worldreader and The Ntimigom School agreed upon a methodology for conducting student reading assessments and carried out the assessments.

- **Community launch event** – On 24 June 2011, several hundred teachers, students, parents, community leaders, local representatives of the Ministry of Education, local church leaders, school board members, local chiefs, councilors and government officials attended a launch
event. Organizers described the value and uniqueness of the project, and the parents and community leaders were encouraged to use and care for the e-reader devices.

- **Inventory management** – The “classroom set” model, in which the set of e-readers is circulated from classroom to classroom, was adopted. If a device malfunctions, The Kilgoris Project is responsible for transporting it to Worldreader’s country representative, who will handle the remaining logistics.

In the October 2011 project report, Worldreader provided information on its monitoring and evaluation efforts. Given the scale of the project, it was deemed impractical and unnecessary to employ a randomized sample and a control group. The project was reported as having met its primary goals, including delivery of 3,150 e-book titles to Ntimigom classrooms and preparation of an additional 13 digitized titles from a Kenyan publisher. There were also “an abundance of capacity building activities,” consisting of the various training efforts. The project report also highlighted next steps for the project, including (1) scheduling periodic calls between Worldreader and the project coordinator to evaluate progress, and (2) planning for the next academic year (including content, assessment of the need for additional devices, and improving Internet connectivity at the school in order to facilitate content downloads).

In terms of project cost, The Kilgoris Project paid USD 19,000 for the package of 3G-enabled e-readers, which included the devices, content, shipping costs and technical support. 202

In March 2012, Worldreader provided an update on the status of the project at Ntimigom School: 203

- Since the initial launch of this project, the school had grown to 400 students and hired two new teachers.
- Worldreader had more than tripled its selection of available free or highly discounted book titles available to students and teachers.
- Although the mobile-enabled Kindles were unable to reliably obtain a network connection at project launch, they were now increasingly able to connect via EDGE and sometimes 3G.
- The Kilgoris Project was working to raise funds for an additional 100 e-readers and 5,000 digital books.

The Kilgoris Project is a U.S. not-for-profit organization founded to support the development of the Kilgoris community.


Information supplied by Worldreader.


5.9 Malaysia

In June 2009, the Malaysian state of Terengganu embarked upon Project e-Book (Projek Buku Elektronik), an effort to improve education through the use of ICTs, training and support. The state government took note of the work carried out by Intel with the Portuguese government’s Magellan project and approached the company to develop a similar program. Project e-Book was intended to bring technology – including PCs, interactive whiteboards and servers – into schools. The ICT infrastructure and training, as well as Internet connectivity, digital curricula and teacher development, were focused on helping students, teachers and schools engage in interactive e-learning programs.

The initiative consisted of four primary elements:

- **Educational content**: Localized content and national school texts were digitized; the sole Malaysian government textbook publisher granted permission to the Terengganu government to pre-install the digital textbooks on Classmate PCs.
- **Training**: Intel Teach professional development was employed to enable teachers to integrate technology effectively into classroom teaching and learning activities. Working with a state government-owned private training agency, the project was expected to benefit more than 3,000 teachers.
- **Technology**: Intel agreed to provide hardware, software and services designed specifically for education, over the course of three phases.
• **Connectivity**: Internet access was provided to the schools via SchoolNet, a nation-wide collaboration between federal government ministries and local ISPs. The PCs provided by Intel were Wi-Fi enabled.

The project plan involved distributing PCs to students, who were allowed to take the computers home, providing the added benefit of giving low-income families access to ICTs. The teachers did not receive PCs until a year after students began using them. Two to three teachers per school received training in Intel Teach Essentials, with the expectation that these teachers would then train others at their schools. The program was planned and managed by a committee that included membership from the state government and other participating organizations.

At the project’s outset, the Terengganu government allocated MYR 35 million annually to fund the project, with the laptops provided free to students. The state planned to increase the funding allocation to take greater advantage of the PCs and to enable one-to-one e-learning in the future.

The project was also designed to involve local industry, in order to foster a sense of community ownership in the project, as well as to generate local employment and economic development opportunities. Industry involvement included the following:

- The state government worked with Intel and a local assembler to open a factory capable of assembling 10,000 Classmate PCs per month.
- Digitized textbook content was provided by a local textbook publisher for pre-installation on to PCs.
- The State Education Department drove participation among district education offices and the Principals Board, and published general guidelines to help school administrators.

As of 2012, 93,000 PCs had been distributed to students in grades from primary Year 4 through secondary Form 2 (ages 10-14 years). They were pre-loaded with digitized versions of standard textbooks, test preparation software, Intel education bundles, the Koran and other religious resources, and a dictionary.²⁰⁵

The Malaysian government has worked with leading universities, SRI International and Intel to conduct research into the effectiveness of the project. Among the findings of that research were certain challenges:

- Teachers did not receive computers at the same time as students;
• The teachers trained on how to incorporate technology into their lessons but did not always pass along such training to other teachers at their schools;
• More interactive teaching materials were needed;
• Infrastructure challenges persisted, including a shortage of power outlets for charging computers and unreliable or slow Internet connections; and
• Students who received their computers in early grades continued to use them at home but lacked updated educational content consistent with their more advanced capabilities.

In response to the evaluations of the program, changes intended to address these challenges were implemented.


5.10 Argentina

Seeds of Empowerment, an offshoot of a research project at Stanford University, aims to increase access to basic education for children living in extremely marginalized communities around the world. Seeds of Empowerment is making use of the Stanford Mobile Inquiry-Based Learning Environment (SMILE), a learning methodology that allows pupils to use mobile phones to generate and share their own educational materials in an interactive way.

The first Seeds of Empowerment project in Latin America to use the SMILE platform was launched in 2011 in the Argentine province of Misiones. It involved the support of the provincial government, telecommunications operator Telecom and a local NGO. The project was initially implemented in 10 rural and suburban primary and secondary schools, and was expected to expand to 20 schools in 2012. The overall objective of the project was to incorporate mobile technology in encouraging critical thinking, creativity, literacy and scientific thinking among students.
The pilot, which took place in August 2011, included training workshops using smartphones and tablets with the Android operating system. Students and teachers were able to participate in various workshops with SMILE methodology, which allowed them to learn through innovative teaching methods and to generate dynamic content in real time using mobile devices. Every smartphone was pre-loaded with several applications associated with various subjects in the school’s curriculum. Each mobile device served three children, and students used the applications to generate questions about lessons or curriculum, working individually or in groups to compose questions on a topic and search for multimedia support to illustrate their questions. The application compiled the students’ questions, allowing them to rank questions in addition to answering them. Results were generated in real time, allowing the teacher and students to see which questions were ranked the highest, which were the easiest, and which were giving students the most trouble.

According to Stanford’s School of Education, one of the SMILE pilots, in August 2011, focused on civic engagement at an urban high school located in northern Argentina. Students were challenged to use SMILE to think critically about what it means to be an engaged citizen in their community. Specifically, students were asked to generate questions for their peers relating to moral dilemmas that might arise in their community. Questions generated by the students addressed issues such as homelessness, suicide, stealing, school bullying, and violence. Each group staged a skit to represent the concepts and captured their skits with photos to generate multimedia questions on their handsets. They would take pictures of ambiguous civic circumstances and create questions for their peers, such as “What would you do in this situation?” or “Who do you think is responsible for this?” By rating each other’s questions, students came to the realization that the best questions were those that divided the class in terms of responses, whereas less-complex questions would not highlight the differing views of their peers. According to the researchers, after three rounds of creating, answering and rating questions, the high school students were generating profound and challenging questions that were relevant to local concerns.


6 Conclusions

Greater government focus on ICTs for education, and ongoing reductions in the price of devices for students, are generating a lot of interest in the potential for boosting computer availability for students in developing countries. This module has examined various issues that should be considered in implementing an LCCD distribution program for schools. It also has presented a variety of country experiences. Based on the analysis, several conclusions can be drawn:

- The selection of a particular LCCD depends on a country’s educational strategy and development status. Some LCCDs, such as the OLPC xo-1 and Intel Classmate, are expressly designed for children in developing countries, featuring special ergonomic and technical characteristics. Other laptops may not have these features and may not be as appropriate for young children. Some laptops may not be suitable for difficult environments, such as extreme temperatures or lack of electricity.
- The selection of a particular LCCD is also dependent on the pedagogical orientation of a country, as well as on government software policies and the age of the schoolchildren. The OLPC xo-1, for example, is specifically aimed at primary school children and may not be suitable for older students. At the same time, traditional mass-market laptops may not be as appropriate for primary school students. Some countries have policies to adopt or favor certain operating systems and software, which also affects LCCD selection.
• The immediate introduction of a one-to-one computing model is beyond the financial capability of most developing countries. Therefore, countries need to consider a phased approach involving a mixture of installing computer labs and distributing individual computers -- the two methods are complementary rather than inconsistent. One-to-one computing will radically affect the school environment. Governments and educational institutions must consider the positive and negative aspects. For example, one-to-one computing democratizes ICTs by making an LCCD widely available to all children regardless of income level, urban or rural location or gender. They can also be taken home, so that every household with a child also becomes a household with a computer. This may well be disruptive to the established learning environment.

• Objective studies about the costs and benefits of education-oriented LCCDs, commercially available laptops, recycled computers and thin clients are still lacking. The evidence to date is not entirely convincing, because it is typically sponsored by organizations that have an interest in a particular solution. Countries also need to be aware that, although there is an altruistic element to many LCCD programs, private companies are profit-oriented. Governments must carefully evaluate LCCDs and plan programs that are driven by the educational sector’s needs and resources, rather than driven by offers of donated computers for pilot projects.

• There must be a long-term commitment to one-to-one computing and LCCDs. Each year, new students enroll and need additional LCCDs. Governments need to ensure ongoing funding and sustainability to support this.

• Another financial challenge for developing countries is the need to balance the introduction of broadband Internet connectivity in schools with promoting one-to-one computing. The goals of one-to-one computing and broadband connectivity are both important, but with limited budgets, governments need to balance priorities. Therefore, it may be difficult to implement both one-to-one computing and broadband connectivity simultaneously. One-to-one deployment plans may need to be adjusted in order for schools to also attain Internet connectivity.

• Mobile education services and applications could allow countries to leapfrog over the computer lab and one-to-one computing models that have dominated discussions of ICT for education for at least the last decade. The potent combination of lower costs, increased computing power, and ubiquity of mobile devices could help overcome one of the biggest challenges to school connectivity: the high cost of buying computers. While mobile handsets, tablets and e-readers may not be able to completely replace more traditional desktop and laptop computers,
they provide a new point of access for school-age children, university students and other learners to educational content and collaboration tools.

• In order to maximize accessibility, mobile learning initiatives should cater to the full range of technology contexts. Smartphones and tablets may have the flexibility and processing power to obtain and run a wide range of applications and services, but there is still a large base of feature phone users. A comprehensive mobile learning initiative should take into account the mix of mobile devices that is prevalent in a particular market and ensure maximum accessibility. For example, feature phone users with Nokia handsets in China, India, Indonesia and Nigeria can access Nokia Life Tools, which the company describes as a “mobile-based, life-improvement information services suite.” Nokia Life Tools provides information targeted not only for education (such as English language learning resources), but also agriculture, healthcare and entertainment. The service had reached more than 30 million users as of August 2011, with the mix of available information and languages tailored to each market. 210

• ITU members can take several steps to consider the potential benefits of mobile devices for their own educational programs and policies:
  ◦ Review existing education (including e-education) policies, programs and plans to determine if they should be modified to reflect the rise of mobile devices and services suitable for education;
  ◦ Consult with education, ICT, and other stakeholders to identify potential areas of agreement, cooperation and potential improvement for m-learning initiatives;
  ◦ Identify the potential benefits and drawbacks to promoting m-learning initiatives;
  ◦ Consider making any relevant revisions needed to create an enabling environment for mobile education tools;
  ◦ Identify potential funding options for m-learning initiatives and pilot projects; and
  ◦ Incorporate mobile devices and m-learning initiatives into education policies and plans in an appropriate manner, and with adequate mechanisms for monitoring their effects.

7 Checklist

Several useful steps, or decision-points, in implementing an LCCD distribution program can be summarized in the following “checklist.”

Coordination
LCCD projects are usually a collaboration between the ministry of education and other partners such as NGOs, international donors and the private sector. Who will participate in the project? Who will take overall implementation responsibility, including integration of pedagogical questions, dealing with LCCD vendors, handling technological issues, coordinating transport and delivery and liaising with schools and volunteer groups? This step involves answering these threshold questions.

School Designations
Which schools will participate? How many students and teachers will be involved? Do the schools have electricity? What languages are spoken? What is the transportation situation? Are parents supportive?

Finance
Where will funding come from? How much are import duties and taxes? Should a tendering process be used? How much of the project should be outsourced?

LCCD Selection
What are the requirements for the LCCD (e.g., operating system, applications, battery life, national language interface, keyboard, etc.)? How much does it cost? What kinds of discounts are available? What kind of support network (e.g., content, training manuals, etc.) are available? What kind of warranties can be obtained? What kind of battery re-charging and plug configurations are available? Should LCCD selection be tendered?

Networking
Is networking capability needed for the project? Do schools have access to the Internet? What kinds of connectivity options are available (e.g., dial-up, DSL, WiMAX, 3G/4G mobile, VSAT)? Is mesh networking needed? What are the costs of networking (e.g., installation of network adapters and routers, recurring service costs)? Can local telecommunication operators or ISPs assist with networking? Are firewalls needed for content control?
Transport and Distribution
How far is the country from the LCCD manufacturing location? What is the lead time for manufacturing the LCCDs? How will the LCCDs be transported (e.g., by air, by ship, etc.)? What are customs formalities and how long is the delay? How will the LCCDs be distributed within the country? What is the deployment schedule?

Content
What education content is needed to support teaching? What content comes with the LCCD? What content is available through the LCCD support network? Is it free? How easy is it to convert existing national content for use on the LCCD? Will new, nationally developed content be needed? Is content documentation available? How will free content be downloaded from the Internet and distributed?

Servers and Peripherals
Will servers be used? What kind of computers will be used for the servers? How much additional disk space is needed? What kind of peripherals (and how many) will be needed (e.g., printers, scanners)? Should servers be included in a tender? Should server support be outsourced?

Electricity
How will LCCDs be recharged (e.g., on-grid or off-grid electricity)? Will universal power supply (UPS) backup be needed? What is the recurring electricity cost?

Training
How will teacher training be implemented? What will be taught? What are the logistics (e.g., centralized training or training on-site)? What kind of documentation will be needed? Should training be outsourced and/or included in a tender? Do the LCCDs themselves have training modules? Is student training necessary? If so, the same questions apply.

Support and Maintenance
How will the project be technically supported? Should support be outsourced and/or included in a tender? What is the maintenance procedure? How will students and teachers be trained in routine maintenance and troubleshooting? What stock of inventory should be maintained for spare components or replacement? What is the procedure for sending LCCDs for repair? How will equipment be recycled?
**Monitoring**

How will the project be monitored and evaluated? Who will carry out the monitoring and evaluation?

Table 7-1: Project responsibility checklist

<table>
<thead>
<tr>
<th>Government</th>
<th>Vendor</th>
<th>International agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Coordinate all the parties concerned within the country;</td>
<td>• Donate devices, including any necessary adaptations for use in beneficiary country (e.g., operating system, national language keyboard, pin configuration, etc.) and reasonable warranties;</td>
<td>• Coordinate with other partners to identify applications and content-related requirements to be included in the devices;</td>
</tr>
<tr>
<td>• Nominate a national project coordinator responsible for coordination with the education ministry and all other partners;</td>
<td>• Cover shipping costs of the devices, including packing for export, shipping charges, airfreight or vessel charge and insurance from the originating country to the port of entry;</td>
<td>• Support local training by underwriting expenses, making arrangements for training at local/regional training institutes, etc.</td>
</tr>
<tr>
<td>• Exempt duties and/or tax for the devices;</td>
<td>• Contribute human resources to provide training and support to teachers in the target areas where the devices will be delivered;</td>
<td>• Negotiate, through the project coordinator, signed agreement with the beneficiary country to ensure its commitment to the project;</td>
</tr>
<tr>
<td>• Identify schools to receive the devices;</td>
<td></td>
<td>• Conduct an evaluation of the pilot phase of the project and identify areas for improvement;</td>
</tr>
<tr>
<td>• Arrange for local transportation of the devices from the port of entry to the designated schools;</td>
<td></td>
<td>• Following the evaluation of the pilot phase, assist</td>
</tr>
<tr>
<td>• Provide supporting infrastructure (including electricity), Internet connectivity, as well as printers, scanners, additional memory devices and servers as</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required at local sites and provide IT specialists to install networks in the targeted schools;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create awareness and organize community learning and information exchange campaigns including meeting at all schools with teachers, students and parents to build their support for the project;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keep other partners informed;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Translate donated training materials into local languages as required;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify a team of IT specialists to participate in the technical maintenance and support training to be provided by the vendor so that local IT specialists will be able to maintain and support the devices.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assume responsibility for software upgrades as required.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide an IT expert to provide service and support to each participating country for at least 6 months;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide initial trainer(s) and training materials on the maintenance of the devices so that each participating country can train national IT experts to repair and maintain the LCCDs;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide trainers, training materials and training sessions for teachers and students on use of the devices, peripherals and content.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the beneficiary country to design a comprehensive national LCCDs in schools program and assist the beneficiary country in launching public tenders for the provision of LCCDs;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 7-2: Feature Comparison of Low-Cost Computing Devices for Students - Laptops

<table>
<thead>
<tr>
<th></th>
<th>xo-1.75 (OLPC)</th>
<th>Classmate (Intel)</th>
<th>Eee (ASUS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>245×230×30.5mm</td>
<td>10.6 x 8.2 x 1.2 &quot;</td>
<td>262 x 180 x 22 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>&lt; 1.5 Kg</td>
<td>3.5 pounds</td>
<td>1 Kg</td>
</tr>
<tr>
<td>Battery life</td>
<td>22.8 Watt-hours (LiFePO4)</td>
<td>Up to 10 hours (6-cell)</td>
<td>Up to 5 hours (3-cell)</td>
</tr>
<tr>
<td></td>
<td>About 4.3-6 hours depending on battery and assuming 3.81 Watts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPU</td>
<td>Marvell 800 MHz</td>
<td>Intel 1.6 GHz</td>
<td>Intel 1.6 GHz</td>
</tr>
<tr>
<td>USB ports</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Form factor</td>
<td>Convertible laptop with pivoting, reversible display</td>
<td>Clamshell</td>
<td>Clamshell</td>
</tr>
<tr>
<td>Random Access Memory</td>
<td>512 MB or 1 GB</td>
<td>Up to 2 GB</td>
<td>Up to 2 GB</td>
</tr>
<tr>
<td>Storage</td>
<td>4 GB</td>
<td>Up to 320 GB HD or up to 128 GB SSD</td>
<td>320 GB HDD</td>
</tr>
<tr>
<td>Operating system</td>
<td>Sugar (Linux-based)/ (Windows XP also available)</td>
<td>Windows 7 or Linux</td>
<td>Windows 7 Starter</td>
</tr>
<tr>
<td></td>
<td>xo-1.75 (OLPC)</td>
<td>Classmate (Intel)</td>
<td>Eee (ASUS)</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------------------------------</td>
<td>-------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Networking</td>
<td>802.11b/g; 802.11s (Mesh) networking;</td>
<td>10/100M Ethernet;</td>
<td>10/100M Ethernet;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>802.11 b/g/n; 3G</td>
<td>802.11 b/g/n</td>
</tr>
<tr>
<td></td>
<td></td>
<td>capable</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>Liquid-crystal display (LCD): 7.5&quot; 1200 x 900</td>
<td>10.1&quot; 1024 x 600 color LCD</td>
<td>LCD 10.1&quot; 1024 x 600 color LCD</td>
</tr>
<tr>
<td>Camera</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>External audio / video ports</td>
<td>Headphone and microphone</td>
<td>VGA, HDMI, headphone and microphone</td>
<td>VGA, HDMI, headphone and microphone</td>
</tr>
<tr>
<td>Warranty</td>
<td>30 days</td>
<td>1 year</td>
<td>1 year</td>
</tr>
</tbody>
</table>

Table 7-3: Feature Comparison of Low-Cost Computing Devices for Students - Tablets

<table>
<thead>
<tr>
<th></th>
<th>Ubislate 7+</th>
<th>Studybook (Intel)</th>
<th>Amazon Kindle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>190.5 x 118.5 x 15.7</td>
<td></td>
<td>6.5&quot; x 4.5&quot; x 0.34&quot;</td>
</tr>
<tr>
<td>Weight</td>
<td>350 grams</td>
<td>1,2 lb.</td>
<td>5.98 oz.</td>
</tr>
<tr>
<td>Battery life</td>
<td>3 hours</td>
<td>6 hours</td>
<td>4 weeks (wireless off)</td>
</tr>
<tr>
<td>Feature</td>
<td>Ubislate 7+</td>
<td>Studybook (Intel)</td>
<td>Amazon Kindle</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>CPU</td>
<td>Cortex 800 MHz</td>
<td>Intel 1.2 GHz</td>
<td></td>
</tr>
<tr>
<td>USB ports</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Memory</td>
<td>256 MB</td>
<td>2 GB</td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>2 GB</td>
<td>32 GB SSD</td>
<td>2 GB</td>
</tr>
<tr>
<td>Operating system</td>
<td>Android 2.3</td>
<td>Windows 7 Professional or Android</td>
<td>proprietary</td>
</tr>
<tr>
<td>Networking</td>
<td>802.11 a/b/g and GPRS</td>
<td>Wi-Fi</td>
<td>802.11 b/g/n</td>
</tr>
<tr>
<td>Display</td>
<td>7” 800 x 480 resistive</td>
<td>7” 1024 x 600 color LCD</td>
<td>6” e-ink</td>
</tr>
<tr>
<td>Camera</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>External audio / video ports</td>
<td>Headphone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warranty</td>
<td>1 year</td>
<td>1 year</td>
<td>1 year</td>
</tr>
</tbody>
</table>

211 Intel Classmate is a reference design licensed to vendors. Specifications here are for a representative sample of one such product.
8 References


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