

A RURAL ICT TOOLKIT FOR AFRICA



AFRICAN CONNECTION Centre for Strategic Planning

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FOREWORD

The African Connection (AC) is a region-wide, African led and managed initiative to harmonize improvements in telecommunications and ICT across countries. The AC has the support of many stakeholders and donors, in particular from the African Telecommunications Union under whose auspices its program has been developed. The New Partnership for Africa's Development (NEPAD) has endorsed ICT as a crucial component of sustainable development and poverty eradication in Africa, and has nominated AC as one of the platforms for accelerated ICT development and diffusion.

AC is seeking to accelerate the development of rural ICT markets, initiatives and strategies across the continent. It aims to create a positive business environment for attracting expanded private investment and new operators into telecommunication infrastructure and information technology, as key planks in a broader effort to foster socio-economic development and growth. This has been perceived as a mammoth task. For example, in 2001 it was estimated that reaching a fixed teledensity of 2% by 2005 would require investments totalling about US\$ 8 billion into telecommunications. However, the good news is that more than this is even now being invested *every year* in African telecommunications. Two-thirds of this is accounted for by investment in mobile infrastructures. By the end of 2001 mobile services had already achieved a penetration of almost 3 percent of population, outstripping fixed penetration and growing at over 100% annually in half the countries. Much of this development is benefiting the poorer countries, bypassing the old order and creating new market structures.

How does this affect rural areas? Mobile is making surprisingly rapid advances into rural areas in some countries and, combined with innovative satellite solutions, the potential of voice-over-IP, innovative investment/development approaches and partnerships and some visionary policy and regulatory tools, no region of Africa need be left untouched for long. From another perspective, the potential revenue generating capacity of Africa's rural telecom and ICT markets are in excess of \$3 billion annually and this alone could justify investments of more than \$ 8 billion per year into rural areas.

However, to date the rural market is still largely untapped, the investments are perceived as risky and the key players who must 'collaborate' to bring about change – operators and entrepreneurs, financiers, governments and regulators, and technology suppliers – are a long way from seeing the opportunity in a mutually cohesive way. Of course rural Africa has its own unique problems. However the explosion in the use of mobile communications, including in rural areas, is providing indications that ICTs that are perceived as useful tools for both socio-economic development and business could attract much more revenues than previously seen and could also greatly impact the lives of rural inhabitants for good.

The African Connection Centre for Strategic Planning (ACCSP), the Secretariat for the AC Program, commissioned a study entitled "Development of Programs and Funding Mechanisms to accelerate rural ICT development in Africa", financed by the World Bank. After a competitive tender, Intelcon Research & Consultancy Ltd. was selected to undertake the study. Intelcon's primary focus and skill base since its formation in 1986 has been rural telecommunications and ICT (policy & regulation, market, business and technology) in emerging markets and developing countries with experience working in over 20 African countries. The project was laid-out for 6 month work duration, started at the end of July 2002 and concluded with a workshop in mid-March in Maputo, Mozambique. The study produced the following reports:

Country market reports

The following ten countries were selected to represent all five key regions in Africa, and differing country circumstances:



- North region Algeria, Morocco
- West region Nigeria, Senegal
- Central region Cameroon, DR Congo
- East region Kenya, Tanzania
- South region South Africa, Zambia

The 10 Country Market Reports are of a descriptive and review nature, summarising the individual current market conditions for rural ICT in each country, analysing current demand and future rural ICT potential as well as identifying regulatory and other obstacles. They include some preliminary and brief conclusions and recommendations.

The main purpose of the country reports however was to use the findings to provide the basis for developing the Rural ICT Program and Toolkit. The Country Market Reports also showcase, to the private sector, commercially interesting market opportunities in rural ICT, and to governments that a considerable proportion of rural ICT infrastructure and services could be viable if given the right policy environment. The reports provide donors and development agencies pointers to which projects could be impactful and self-sustaining.

The methodology used for the country reports is described in the “Guide to Rural ICT Market Opportunities Report”. All 10 reports were delivered beginning of October 2002, approx. 2 months after project start.

Rural ICT Program

The study developed a program for AC and its stakeholders that can accelerate rural ICT development in Africa, is sustainable and promotes public-private sector co-operation. The program is geared to assist AC to work with national governments and the private sector to promote and support establishment of ICT funds for local projects. The final version of the Program was delivered beginning of November 2002, approx. 3 months after project start.

On a very high level, the program can be summarised as follows:

- *Focus on public access vehicles, covering rural telecommunications, Internet access & service points as well as advanced ICT services to agencies best able to leverage ICT for rural development impact. Public access vehicles should be small-scale, demand-driven and run by local entrepreneurs on a commercial basis. They require public sector support, initiative and creative partnerships to kick-start their emergence and mass-replication.*
- *As a basic stated principle and means to influence Governments and regulators, support the required reforms, policies and strategies for overall ICT sector development. In particular AC should promote, pilot and publicise best practice of innovative public access business and partnership models.*
- *In carrying out its program of actions, model best practices in policy, financial assistance mechanisms and business partnerships, and promote and facilitate public-private partnership for public access models.*

While each country will require a slightly different approach depending on the specific opportunity and combination of current environment, the AC program could undertake or promote the following four activities:

1. **Rural public phones or PCOs:** In each country support the required next step of public access development, commencing at the most basic level, facilitating rural access businesses and networks. Promote the (Mobile) ‘Virtual Network Operator’ or Reseller concept whereby an entity buys and resells airtime to rural local entrepreneurs, possibly even partnering with the operator to expand the network further into rural areas. [A pilot project illustrating this concept was undertaken as an extension of this study and is described in Annex D];



2. **Regional ‘next level’ Internet POPs:** Where required, promote and finance/subsidise through competitive tender the expansion of Internet points of presence (POPs) and local dial-up into the ‘next down’ level of regional towns (e.g. district centres) from where ‘intermediate agencies’ with active rural programs, social infrastructure institutions, vanguard schools, health institutions and SMEs will be able to gain access to the Internet with good quality (e.g. high speed wireless) and/or local dial-up;
3. **Networks for rural ‘Intermediate’ agencies:** Enable and support the implementation of computer networks and other ICT needs by ‘intermediate agencies’ – i.e. NGOs, micro-credit, local government and social infrastructure agencies that have direct activities in rural areas and thus are able to serve rural communities better;
4. **Small-scale telecentres:** Instead of financing and owning the facilities and infrastructure for large MCTs, provide small business matching grants or loans and business plan assistance for the ‘bottom-up’ expansion of already existing and successful PCO businesses into the next stage of ICT service provision, to become info kiosks or mini telecentres. Also maximise existing potential for privately owned and operated telecentres to expand activities into training, capacity building and rural community outreach through partnership with donor agencies under-writing their demand and that of their clients for these services.

The Rural ICT Program is also based on a high-level review of what other Africa-wide organisations are already focussing on, and thus attempts to avoid duplication and to fill in gaps.

The Rural ICT Program report thus develops a prescriptive framework and focuses on means to accelerate rural ICT development in Africa. It justifies the basic recommendations by providing a comprehensive analysis on the situation, experience and potential for traditional media, telecommunications services, and Internet and ICT applications. It is a synthesis of the 10 country reports, summarising demand, highlighting key obstacles, providing solutions and ways to exploit market opportunities, developing recommendations of what an AC program could do to assist in the process. The report on the Rural ICT Program is available separately.

The third key component of the AC study on rural ICT is this Rural ICT Toolkit and the introduction in the next section gives an overview to it. The study was followed by a pilot designed to illustrate one of the key market development concepts identified in the study. The pilot activity is described in Annex D.

Methodology

The methodology for the entire study included three essential components:

African associates: We worked with 9 African associates, namely Muriuki Mureithi (Kenya), Mike Jensen (S. Africa), Chris Tembo (Zambia), Karim Laraki (Morocco), Wawa Ngenge (Cameroon), Birane Ndiaye (Senegal), Pele Ntumba and Elieen McKeough (DR Congo) and Magda Ismail (Egypt). Some acted as sounding boards throughout the project, others provided on-the-ground research in individual countries. Intelcon used four in-house staff with complementary expertise on this project and in addition associated with Analysys Ltd.

Consultative process: The deliverables have been developed in close collaboration with the ACCSP and stakeholders of AC. In fact, the Rural ICT Program and the Rural ICT Toolkit have seen several further iterations after the official delivery date to refine the document and incorporate additional comments and feedback. A workshop attended by over 150 stakeholders was held in Maputo Mozambique early March 2003 and suggestions from that workshop were incorporated in the Toolkit.

Extent of market assessment: Intelcon used its own background of primary demand research (i.e. representative rural user interviews in African countries) and secondary source data, combined with in-country research by our African associates to model, estimate and assess market potential of rural ICT in each of the 10 countries. However, specific primary end-user surveys in rural areas were beyond the scope of this project.



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1 INTRODUCTION

1.1 General

The objective of the Toolkit is to act as a 'basic platform document' to bring all of the key players together with a common understanding of rural ICT development and an agreed checklist of what is needed to:

- prepare programs and projects,
- document the projects, and
- demonstrate development impact, long-term commercial viability and justification for financial start-up support.

It is anticipated that this will result in sustainable programs/projects that are scalable, replicable and upgradable.

The Rural ICT Toolkit concentrates on the "how to" of implementing rural ICT programs and projects. It is aimed at providing state of the art knowledge and best practice on rural ICT development, basic recommended standards and tools for rural ICT initiatives. Among other things, it summarises best practice on rural ICT policy, funding principles & processes, monitoring and evaluation. It provides a basic understanding for technology options available. It offers a framework to select appropriate rural ICT projects, and it explains essentials of demand studies, business plans and socio-economic impact analysis.

The Rural ICT Toolkit is addressed mainly to African policymakers and regulators and other interested parties who wish to develop rural ICT programs and projects in their countries. It is also aimed at those wanting to foster regional harmonisation, allowing for cross-border initiatives that can increase economies of scale and thus the attractiveness of the rural ICT market to private investors and players. However, we expect it also to be useful for private sector players wishing to promote projects, by providing a checklist of issues and components to be addressed in project preparation and approaches to donors and other financiers.

The toolkit brings together a compilation of essentials, best practices and checklists for the planning, financing and implementing of telecom and informatics projects in the rural African context. The Rural ICT Toolkit is aimed to assist African countries implement concrete programs and projects that will attract broad support within Africa and generate interest from without for rural focused ICT investment.

Sometimes the key players in African ICT development - policy makers, regulators, financiers/investors, donors/development agencies and service providers - are poles apart in their thinking. It is especially important to bring the public and the private sectors as well as civil society closer together, as only private sector involvement with public sector support and/or partnership, as well as civil society mobilization and promotion, will be able to overcome the challenges to bring sustainable ICT to rural areas.

The toolkit explains crucial elements of rural ICT program and project development at the national level. It provides checklists and tools relating to essential components, in approximate order of priority in which issues must be considered. Each is addressed in a separate chapter of the document.

1.2 Overview of key steps

The following is an overview of the various steps and actions required for developing a pro-active rural ICT policy and implementing rural ICT projects. It refers to the chapters of the Toolkit dealing with key aspects. Not every single action is covered in this Toolkit, though references are made in the chapters for relevant further literature and documents.



Sector reform & Universal Access (UA) Policy Chapter 2	►	In many cases progress of general communications (ICT) sector reform alone will improve the market efficiency significantly and allows the operators to grow and expand much more rapidly, in the process covering more rural areas and low-income customers. Thus any rural universal access policy should be part of an overall sector reform process. Developing a UA policy consists of several steps and alternatives, including setting up a UA fund. Steps are described below.
Results/Outcome	►	Coherent and integrated UA policy, not funding market inefficiencies
Removing bottlenecks – First steps closing the market efficiency gap Chapter 2	►	An immediate action with short-term results should be to identify barriers, bottlenecks and disincentives to rural service expansion. Probably the most effective way is to hold a consultative workshop with the communications industry and other interested stakeholders, inquiring what is perceived as problems for service expansion and what possible incentives might be (e.g. tax holiday for revenue from rural areas). Suggested measures can be categorised into short-term and medium- to long-term. Examples for short-term measures which can be implemented in many cases fairly easily and rapidly with the political will behind it, are: reduced import duties for ICT products, lower licence and regulatory fees, more flexible tariff regulation, national Internet exchange points etc. Medium-to-long term measures are often related to overall sector reform and usually need more time to be implemented. Often issues such as exclusivity for the incumbent or other licensees dictate certain timeframes. However, innovative instruments such as asymmetric interconnection, de-averaging national rates to reflect network costs on a disaggregated urban/rural basis, could be implemented soon. Ideally, a pilot should be implemented first.
Results/Outcome	►	Immediate actions & dialogue with industry
Establishing a UA Fund Chapter 3	►	The process of establishing a UAF should be part of the sector reform process and should start early, before or at least in parallel with the activities below. For this Toolkit we assume that UA objectives and UAF establishment have already been written into the communications (ICT) policy and law. Key decisions need to be made on its institutional set-up and operating principles and guidelines.
Results/Outcome	►	Established and operational UAF ready to implement
Assessing the market reach Chapter 4	►	First a country has to assess which rural (and in some cases urban or semi-urban) areas will not be served by operators on a commercial basis. It is important to not only look at the current situation but to assess future communications service coverage, for both telecommunications and Internet, as there will be a time delay for when the UA strategy will be implemented. This can take possibly 2-3 years. Thus the assessment needs to predict what operators and ISPs will have achieved by the time the UA fund will be fully operational. This assessment is usually done by independent consultants talking to all key service providers about their current infrastructure and expansion plans. The assessment should also include a preliminary model in which viable and non-viable areas are indicated (by state, province, district or whichever seems most appropriate). The model should show, based on broad assumptions, revenue potential and average cost to provide service, as well some initial calculation of the size of the financial inputs that would be required to make them viable.
Results/Outcome	►	Understanding which areas need special intervention, first indication of how much subsidy is required
Developing appropriate UA targets	►	In order to develop appropriate UA targets within the areas not likely to be covered by operators, there are three main considerations: a) They should match expected levels of demand in rural areas (avoiding especially oversupply)



- b) They should be areas that justify to receive (smart) subsidy
- c) They should be realistic in light of UA funds available

It requires a demand study and a socio-economic impact analysis to develop appropriate UA targets, for both telecommunications and Internet.

Demand study Chapter 5	►	The extent of the demand study depends on the spread of areas likely to be left without service. In most cases it is not required that the demand study satisfies academic standards of representation. However, it should be carefully designed to include locations that are representative of the respective regions, its rural areas, economic make-up, topography etc. The study needs to capture different types of rural areas and also include towns as likely targets for Internet coverage. In addition it needs to have control groups of villages and towns with existing service and their usage.
Results/Outcome	►	Demand forecast for services in un-served areas, including user affordability
Cost estimates Chapter 6	►	<p>Based on several factors, including demand levels, population density and topography, approximate cost estimates need to be developed for serving the as yet unserved areas.</p> <p>This needs to take into account current infrastructure (e.g. backbone) and possible regulatory restrictions to use certain technologies. The cost model should include at least 2 different technologies or a mix of them.</p> <p>The model does not require a detailed cost study as it will be used as a ceiling for the maximum subsidy, but it should be based on an investigation of specific local cost issues (e.g. security, transportation, local taxes, cost of alternative power supply).</p> <p>Annex B provides a Basic Rural ICT Evaluation Model to be used as a guide.</p>
Results/Outcome	►	Understanding of the costs involved to achieve UA targets
Socio-economic benefit analysis Chapter 7	►	<p>Using the demand and affordability data from the demand study and the estimates from the cost analysis, a socio-economic benefit analysis should be used to establish:</p> <ul style="list-style-type: none"> a) Where a subsidy is justified, and b) What the maximum subsidy requirements are c) Priorities in case existing funds do not meet subsidy needs <p>The Basic Rural ICT Evaluation Model of Annex B includes guidance on calculation of an Economic Valuation Factor and economic rate of return.</p>
Results/Outcome	►	List of areas requiring & justifying subsidy, finalisation of appropriate UA targets & max. subsidy amount, priorities
Public tender and funding Chapter 2, 8 & 9	►	<p>This requires developing specific projects, ranging for example from several country zones in which to provide public access telephony, and Internet POPs in certain unserved cities and towns, to smaller ICT projects handled by entities other than operators and service providers.</p> <p>Tender documents need to be developed, ideally in consultation with the industry, as well as licences/authorizations and subsidy contracts. The key is to have an open and transparent process.</p> <p>The bidding process needs to include a bidder evaluation process, based on previously published evaluation criteria for both pre-qualification and specific bid evaluation.</p> <p>A sound business plan is essential for the evaluation, in particular for smaller and unproven projects.</p>
Results/Outcome	►	Design of specific 'projects' or 'programs' and competitive selection of operator, service provider or other entity implementing the projects and providing the service



Monitoring & Evaluation Chapter 10	► The specific rural ICT projects need to be monitored. In cases of subsidy contracts and/or new rural licences/authorizations the performance needs to be monitored to disburse funds. But monitoring is also important for early problem detection and improvements of the projects and processes.
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Results/Outcome	► A mechanism to ensure successful implementation, minimise failure and improve strategy, processes and projects
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2 RURAL ICT POLICY AND REGULATORY FRAMEWORK

Overview: This section provides an understanding of what policies are best practice in the context of economic reform and market development, and what are the various measures that support and promote progress towards universal access to ICT in poor and rural areas – closing the gaps between rich and poor. It defines universal access and explains that measures to support the development of a well-functioning, liberalised market must be the prior focus of policy makers. Two gaps are thus defined and the measures to address them described.

► A '*market efficiency gap*' which must be addressed as a matter of priority to ensure that markets operate freely, unencumbered by monopolistic interests, that consumer pricing and interconnection prices reflect true costs and provide the right incentives to service providers

► The '*true access gap*' which reflects the fact that some areas will not be reached by the market, even if it is operating efficiently. This is due to a combination of remoteness, poverty, high cost and other factors that would leave the areas unreached without intervention. Universal Access funding – for which there is now an emerging best practice - is the measure of last resort designed to reach those areas beyond the commercial limits of the market place.

2.1 Policy & Regulatory Foundations

It is hard to establish a successful rural ICT project in a 'hostile' environment where the policy and regulatory framework is unfavourable, with little or no local buy-in, ownership or participation. This risks that local or external resources are not optimally used. As a minimum requirement, countries to be selected for a project should at least have subscribed to general telecommunications sector reform and ICT policy and development, and embarked on the process.

The checklist below gives an overview of the key elements to be developed, reviewed or modified within the telecommunications sector reform process¹.

Telecom sector reform checklist

- Corporatised and privatised telecom incumbent
- Independent, facilitative and effective regulator
- Rebalanced, cost-reflective tariff regime, and reform of international accounting rates
- Introduction of competition: data & mobile services, public & private, basic services, etc.
- Competition policy: ensuring level playing field
- Clear licensing regime
- Fair interconnection regime
- Spectrum Allocation Plan and clear management process
- Numbering plan (number portability, long-distance carrier selection)
- Harmonisation with regional and global standards
- Rural telecommunications development and Universal Service(US)/Universal Access (UA) Policy
- Establishment of a US/UA Fund



Once countries have embarked on the process of sector reform, it is possible to design and implement rural ICT projects even in this interim environment.

The next section, 3.2, will focus on describing key elements and best practice of *rural* telecommunications development and Universal Access policy.

Whereas telecommunications sector reform is crucial and is the starting point, countries need to go beyond telecommunications sector reform and address a wider range of issues to develop and diffuse ICT and its usage in their countries, harness their benefits for socio-economic development and contribute to building an information society. Often the preparation of a National ICT Policy/ 'National Information & Communications Infrastructure' strategy is considered an essential foundation to the development of advanced ICT applications². At the very least, there is a need to synchronise and consolidate various policies in telecommunications, ICT/IT, NICI, broadcast and postal services, where they exist, or to develop one that is inclusive of all.

The African Information Society Initiative (AISII) has broadly defined key issues that should be addressed in a national ICT policy. The following list, from the AISII, is intended to guide the development of national ICT policies, strategies and infrastructure plans³:

- Creation of the necessary enabling environment to facilitate the deployment, utilization and exploitation of ICTs within the economy and society (e.g. through the implementation of special tax packages, instruments and incentive programs; the facilitation of an investment climate for the mobilization of financial and technological resources, removal of existing regulatory and bureaucratic barriers, etc.);
- Development of a local ICT industry to facilitate the production, manufacturing, development, delivery and distribution of ICT products and services (e.g. through support for R&D);
- Development of the national human resource capacity to meet the changing demands of the economy (e.g. through ICT training and education in schools, colleges and universities);
- Development of the national information and communications infrastructure;
- Development of the legal, institutional and regulatory framework and structures required for supporting the deployment, utilization and the development of ICTs (e.g. national ICT structures and bodies; legislation around e-commerce, Intellectual Property Rights, data protection, security and freedom of access to information etc.);
- Development and promotion of the necessary standards, practices and guidelines;
- Development of sectoral projects addressing national socio-economic development priorities (e.g. development of ICTs to support the operations of the civil and public services; development of ICT initiatives in sectors such as health and education);
- Engagement of government as a model user of ICTs – to provide an example and encourage the expansion of local markets;
- Fostering the application of ICTs in the private sector to improve the efficiency and effectiveness of businesses both large and small, and especially supporting electronic commerce.
- Development of mechanisms to ensure the participation of women in the formulation of ICT policies and ensure that such policies address the specific developmental needs of women.

This document will not provide further guidance on the details or preparation of National ICT policy, as various agencies are active collaboratively in this area under the umbrella of the African

¹ It is beyond the scope of this *Rural* ICT Toolkit for Africa to discuss general telecommunications sector reform policy and regulation. A good guide is the "Telecommunications Regulation Handbook" edited by Hank Intven, McCarthy Tétraut, Nov 2000.

² Africa-wide the status of NICI Programmes is as follows: 16 countries are implementing NICI programmes, 11 are half-way through NICI programmes, 7 have launched the NICI program development process and 18 have not yet started the NICI process. Source UNECA May 2002

³ Source: Economic Commission for Africa - African Development Forum 1999 - Post ADF Summit - Information and Communication Technology Policies and Strategies

[HTTP://WWW.UNECA.ORG/AISSI/DOCS/PFSPOL.PDF](http://www.uneca.org/aissi/docs/PFSPOL.PDF)



Information Society Initiative (AISI). However, they are important frameworks for rural ICT development. It is important that the various bodies involved in telecommunications sector reform, ICT policies and also broadcasting co-ordinate and co-operate with each other.

The following section describes what specifically needs to be done beyond general sector reform and national ICT policies.

2.2 Definition of Universal Access

Universal Access (UA) is the policy objective to provide convenient and affordable communications access, on a community basis, through public access facilities such as payphones and telecentres to the whole population. Often in many countries there are already public payphones, PCOs and phoneshops in urban centres, thus a UA strategy often focuses on rural areas and in peripheral or unserved urban areas.

UA is the forerunner to Universal Service (US), which is the objective of making facilities available individually, to every household for a reasonable price. This is mostly the policy objective in OECD countries, although some developing countries refer to their *UA strategy* also as a US policy.

In reality, it is more practical for developing countries to think in terms of UA – i.e. the achievement of public access at the community or neighbourhood level - in the near-to-medium term, while regarding US as the long-term objective.

UA may be defined as placing one or more publicly accessible telephones in every population centre above a certain population size; or placing public phones such as to guarantee that anyone, no matter where they live, need not walk more than a certain distance – e.g. 5 km - to reach a phone.

In addition, a UA policy may include targets such as the following:

- to connect all local government, social infrastructure (e.g. health clinics), schools, institutions and businesses demanding service with private line service, whether by wire or wireless means;
- to establish Internet Points-of-Presence and at least one public Internet access vehicle in all administrative centres down to a certain level (e.g. district headquarter towns); and
- to connect every school above a certain grade level or size (e.g. all secondary schools) to the Internet.

2.3 Two access gaps – requiring different responses

Before we discuss the policies required to promote and achieve Universal Access, we need to understand the problem fully, otherwise policymakers cannot develop appropriate responses. This section differentiates between two separate access gaps that need to be treated and remedied with different approaches.

When talking about the challenge of reaching the whole populace, including the poor and rural population, with communications services, it is often referred to collectively, without distinction, as 'the access gap'. However, we can identify two separate 'gaps', which must be understood and addressed differently. We refer to these gaps as the *market efficiency gap*, and the *true access gap*⁴.

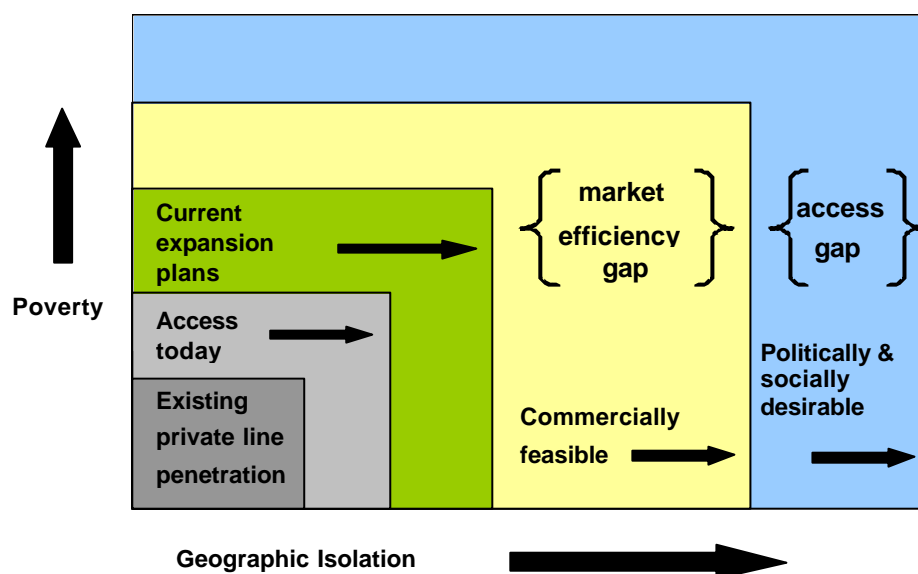
⁴ The conceptual framework of the two gaps is developed in the World Bank Discussion Paper No. 432, *Telecommunications & Information Services for the Poor: Toward a Strategy for Universal Access*, Juan Navas-Sabater, Andrew Dymond, Niina Juntunen.



There are also two dimensions to the challenge of achieving universal reach, both of which need policy makers' attention: these are poverty and isolation. Poverty of course exists in both urban and rural areas, however the cost of addressing both poverty and isolation together, as exists in many rural settings, is much higher. Providing access to the urban poor can be done through policies and innovative measures that are well within the reach of the market, often without much special finance. The main requirement is to allow entrepreneurs who wish to re-sell and retail services to people who cannot afford their own private communications facilities to be free to do so.

On the other hand, reaching some poor *rural* areas may be well beyond the reach of the market. The following diagram illustrates the concept of how we can determine the limitations of the market place. The two axes illustrate the two critical dimensions – relative poverty and geographic isolation.

Looking first at customer penetration (bottom left hand corner of the diagram), in most low-income countries the current telecommunications network reaches only a small percentage of population and geographical area.



Source: World Bank Discussion Paper 432, "Telecommunications & Information Services for the Poor: Towards a Strategy for Universal Access", by A.Dymond, N. Juntunen, J. Navas-Sabater, 2000

However real access, even today, goes well beyond the limits of private residential penetration, to the second frontier. Payphones are traditionally the main means for those without a phone to access the network. Many private phones, including mobiles, are also shared, or access time is re-sold by businessmen, government officials, teachers or other individuals allowing others to make and pay for calls. This all adds up to a much broader access than pure 'teledensity' implies.

A further access frontier (the third line) will be reached when the build-out plans or obligatory targets of existing operators are reached. However, examples around the world show that obligations are often only slowly and unwillingly fulfilled (if at all) and therefore can be considered less effective measures. This is especially the case for incumbent operators not yet privatised and retaining their monopoly. The situation is compounded further if policies and regulations discourage operators or new entrants from reaching or exceeding the obligations, e.g. insistence on maintaining inflexible low tariffs that do not allow operators to at least recover costs from obligation payphones. The plans and targets of fixed operators often leave a huge gap between planned reach and what might be feasible.

There is also still the perception that rural areas are loss making, whereas there is often *much more* affordability than many believe to exist. For example, the large demand for urbanised people to call their relatives and friends back in the village (i.e. the incoming call market) –



amounting to several times the revenue generating capacity of the rural areas themselves – is largely ignored by conventional telecom economics.

The market efficiency gap, then, is the difference between what markets are actually achieving under current conditions, and what they could achieve if regulatory barriers were removed and regulation is used to provide incentives. This gap can be bridged through more private provision of service facilitated by effective competition and by market-oriented policies and regulations that create a level playing field for new entrants. The only question relates to how far the market can reach commercially, and how best to implement and sequence more competitive conditions. Effective market-oriented regulation sets the stage and creates the environment for operators to be able to serve a much broader area and populace and thus close the market efficiency gap. This frontier can be reached within the context of general telecommunications sector reform and does not need subsidies.

The true access gap recognises that intervention is still required to reach some areas and population groups that will not be served even with the most attractive, liberal market conditions. There are people and places that remain beyond the limits of the market unless additional investments are mobilised through intervention, in the form of subsidies or other special incentives to encourage service providers to enter. A Universal Access policy is focused on the true access gap – i.e. extending the market into marginal areas.

2.4 Policy and Regulatory measures to address the market efficiency gap

As explained above, in many cases progress of general telecommunications sector reform alone will improve the market efficiency significantly and allows the operators to grow and expand much more rapidly, in the process covering more rural areas and low-income customers. Providing financial subsidies to operators to serve rural areas through a Universal Access Fund (UAF), described in the next section, is a measure of 'last resort'. First, all possible non-financial regulatory and policy measures and innovative approaches should be taken to improve market efficiency and provide non-financial incentives to operators to serve rural areas. Implementing a UAF in an ineffective, fairly unliberalised market will be very costly and fund the inefficiencies instead of addressing the true access gap. While we cannot describe and address in detail all the measures required to reform the telecommunications sector, we are highlighting here a few selected measures, which are particularly important to rural telecommunications.

Tariff regulation

Understandably many regulators tend to insist on keeping the tariffs low, especially in rural areas, as they know the affordability is lower than in urban areas. However, often this has the opposite effect of what is desired. If operators are not allowed to charge somewhat higher tariffs in the more costly rural areas, they have no chance of recovering their cost and making a profit. In consequence, they tend to avoid serving rural areas and if they are forced by obligations, they try to minimise their attention, effort and resources as this is loss-making to them. This results in either no service at all or very poor services for rural areas.

Whereas affordable service for all incl. rural areas is the ultimate objective of a universal access policy, it might be beneficial for an interim period, say 3 to 5 years, to allow operators to charge say 30-50% above urban tariffs. This would incentivise them to build out infrastructure in rural areas. The best evidence that this works are the many mobile operators in Africa. Mobile tariffs are often less regulated than fixed tariffs, or not at all. The combination of tariff freedom and competition has allowed (and forced) mobile operators to grow more rapidly, and venture into rural areas. Furthermore, rural dwellers often develop innovative ways of using the network to their advantage once it arrives – e.g. through sharing phones, extensive use of call-back or 'beeping' their urban contacts who are willing to pay for the calls.



Reselling Regulation

The many examples of PCOs, in Senegal, South Africa, Morocco and elsewhere show that a deliberate PCO strategy can improve public access. The first requirement however is that the regulatory regime allows and protects the reselling of telephony and other ICT services.

A review of the examples shows that PCOs seem to thrive where they have the support of the operator (e.g. Senegal, Morocco). This includes that the operator offers an attractive revenue share to the PCO retailers and regulates to a certain extent the locations of PCO, so there is competition but not 'tariff cannibalisation'.

There could be different models too. If the operator finds it too complicated to deal with all the PCOs, another commercial entity (a 'virtual network operator') could buy bulk airtime or lines and develop a PCO retailing business. This is the model of the well-known Grameen Phone enterprise in Bangladesh, described in Annex C. The pilot sponsored by this project, which investigated establishing a similar concept in Nigeria, is described in Annex D.

Interconnection

Fair interconnect agreements are a regulatory pillar in market liberalisation and, particularly important for the rural market, as it limits the size of subsidies required. Ideally, countries should consider implementing an asymmetric interconnection regime based on the principle of disaggregated costs, for operators serving rural areas in developing countries.

Between fixed network operators, the payment of a higher fee to terminate a domestic telephone call in one direction than in the reverse direction is an uncommon practice, although it is well established historically as a means to ensure the viability of small rural operators in Canada and the USA.

An interconnection regime that allows different network access charges, based on the operators' true costs, would obviously require a fundamental movement away from nationally averaged rates. Despite huge potential benefits for rural telecom development, it could place another burden on young regulators. Furthermore, the technical issues relating to numbering plan, call accounting and inter-operator billing could present some obstacles in some countries.

However, it is well known that unfair interconnect practices and weak regulation have plagued and hindered the emergence of true multi-operator and competitive markets, most of which could have benefited rural areas greatly. This has occurred in markets as widely dispersed as Poland, Czech Republic, India, Ghana and Bangladesh.

The justification for *asymmetric* interconnection, is that a) rural networks cost much more (e.g. 6-10 times more) to establish and operate than urban networks and that b) users are willing to pay additional tariff rates to cover additional costs:

1. The cost of rural networks is much higher than urban networks

This is due to lower user density (e.g. less than one telephone per square kilometre, rather than hundreds or thousands per square kilometre in urban areas); the length of the 'customer loops', often necessitating special wireless technology; and the challenging nature of the support structure (e.g. no reliable power supply). Operational costs such as maintenance and transportation are also costlier. While much has been written – mostly by promoters of wireless technology - to prove that costs are reducing, the cost reductions are throughout the network. The *differential* between rural and urban networks remains such that rural networks are often still at least 6-10 times more costly to establish and operate than urban ones and should therefore have higher termination rates⁵.

⁵ Historic cost differentials quoted by the ITU are that rural lines are 7 times costlier than urban. Many examples and graphs can be used to support a similar differential today. Edgardo Sepulveda (McCarthy Tétrault), in a document to CTO and ITU entitled *Model Universal Services Fund Policies and Procedures, Part II*, June 2002, notes from Cribbett (2002) that "average lines costs in low-density areas of Australia were found to be between 6 to 10 times the average cost per line in the rest of Australia". Per-line costs in one of the Chilean rural networks, at \$5,000, are clearly at least 6-10 times typical urban costs and this is reflected in the cost modelling exercise undertaken to establish interconnection rates in that country. Many similar cases in developing countries can be cited.



2. Users will pay extra tariffs for rural services that do not exist today

There is strong evidence that users in developing countries are generally willing to pay higher charges to cover the cost of higher interconnection. This comes from studies indicating that low-income people will pay at least the world average of 2-3% of income on telecommunications. Also, in user surveys urban users have stated that they would pay extra to be able to call rural communities that have no phone today⁶. In addition, the current world-wide experience of mobile networks using calling party pay (CPP) billing is that customers generally are used to paying for additional interconnect charges by paying higher retail tariffs for inter-network calling.

These arguments appear to be more relevant to developing country situations, striving for universal access, where there is still a critical need to develop rural networks under conditions of resource constraints. Whereas some advanced countries recognise the cost justification requirement for asymmetric interconnection, they do not have the same shortage of existing services in rural areas and choose to maintain geographically averaged tariffs under their *universal service* objectives and thus to cover differential costs with subsidies rather than calling party charges. This is the specific luxury that advanced and resource-rich countries have.

This being the case, the availability of asymmetric interconnection would provide a better commercial foundation for groups considering an investment in rural telecoms or responding to tender calls for rural licenses through universal access or rural development funds. By creating higher interconnect revenues than offered at present, asymmetric interconnection could harness the well-known fact that there is more pent-up demand for telephone calls from urban centres into low-income rural destinations than the reverse.

The downstream mechanisms for this could be the sharing of incoming call revenues with public payphone service retailers, incentivising them to develop the market for incoming urban-to-rural calls, messaging and 'virtual telephone service.' This would improve access to telecommunications for a much wider segment of the population.

Asymmetric (dis-aggregated and cost-based) interconnection is thus one important mechanism that should help to close the 'market efficiency gap', by enabling the market to work more effectively and reach further into the rural heartland⁷. Subsidies from universal access funds can then concentrate on the 'access gap' for rural telecommunications that still exists beyond the limits of the market place.

Minimising Regulatory Fees

Policymakers and regulators have the option to minimise regulatory fees for operators and service providers that specifically target rural areas. By doing so they lower the cost for the rural operator and possibly pushing the rural operation from unviable or only marginally profitable to being viable and attractive to investors.

Regulatory fees that should be reviewed and minimised or even cancelled include spectrum fees, universal service/access fund fees, licensing fees and other regulatory fees.

2.5 Universal Access Policy for the 'true access gap'

In a liberalising environment, a financial strategy to encourage and enable private sector operators to invest in meeting UA targets for service provision beyond the commercial limits of the market place is required. This typically should include a Universal Access Fund.

⁶ *Policies and Strategies for Rural Communications in Uganda*, March 2001, Report submitted by Intelcon to UCC, contained an extensive user baseline survey that documented, among other things, a high demand for urban-to-rural calling and willingness to pay higher on urban-to-rural calls.

⁷ From *Telecommunications and Information Services for the Poor: Towards a Strategy for Universal Access*, World Bank Discussion Paper No. 432, Juan Navas-Sabater, Andrew Dymond & Niina Juntunen, 2000.



The Universal Access Fund (UAF) is a generic name for a telecommunications development fund. This is becoming a widely accepted mechanism for mobilising *private sector* investment into high cost areas, within a liberalising environment. UAFs usually focus on rural network access and are sometimes named to reflect this⁸.

The funds, which typically offer once-only start-up subsidies for designated areas, have mainly focused on creating and supporting telephone service licenses, starting with village payphones. Some now support Internet access and advanced ICT projects. The UAF model is just beginning in Africa and thus 'best practice' needs to be taken from areas in the world where the most experience has been built. While the key principles and elements are universal, some details of design and implementation will doubtless need to be evolved and adapted to the African situation and to accommodate changes in technology and service concepts over the next few years.

Fundamental concept and management

The UAF is a tool, used mostly within a liberalised market, for reaching beyond the limitations of the market. UAFs are usually managed by an entity that is independent of both government and operators. In the majority of cases they are under the auspices of the regulator, though with a separate manager, board of trustees, bank account and reporting procedure.

UAFs are a means for the communications sector to meet the challenge of achieving universal access (UA) and country-wide market development from its own resources, and equitably. In most UAF examples to date, money is channelled from license fees, spectrum charges or a special levy (e.g. 1%) on the revenues of all operators and is set aside to assist those operators willing to serve high cost, challenging rural areas.

Thus the UAF, in net effect, re-distributes a small amount of finance from those who would rather not be saddled with the responsibility of serving difficult areas to those willing and eager to do so. Applying the funds to those operators with good motivation and willingness to leverage further investment is a key advantage of the UAF model. The rural market is then developed by those who want to do so, to the benefit of all. This is a 'win-win-win', since all operators benefit from long-term market growth by paying rather a small amount, those wanting to serve rural areas get an opportunity to receive financial help, and customers benefit from additional network coverage.

The subsidy auction mechanism

The competitive mechanism for distributing UAF subsidies is usually a 'reverse auction'. The Fund administration studies and estimates the maximum subsidy required to allow an operator to serve a designated area or group of communities, and sets this out as the subsidy available to the winning bidder.

Applicants are invited, through public tender, to bid for a license to serve the designated areas, and the license is awarded to the bidder requiring the lowest subsidy, subject to that operator passing a pre-qualification process. Pre-qualification is required to ensure that bidders meet minimum technical and corporate criteria and are capable of providing the required services.

Each country has a different standard as to who should contribute to the UAF, whether just fixed operators, fixed and mobile, ISPs, or even the postal sector. In principle all those likely to benefit from the activities of the Fund should contribute equally in proportion to their revenues. In principle, best practice for a UAF geared to address the whole range of feasible ICT deployments is for all communication businesses to contribute and be eligible to draw on the fund resources⁹.

⁸ Fund for Investments in Telecommunications – Peru; Rural Communications Development Fund – Uganda; Rural Telecommunications Fund – Tanzania (proposed); Telecommunications Development Fund – Chile, Dominican Republic, Nigeria (proposed)

⁹ In Uganda, all communications businesses – fixed and mobile telecom companies, ISPs, the Postal Corporation and courier companies - contribute 1% of their revenues and the Fund in turn addresses itself to supporting not just telephony, but all kinds of ICT and document delivery services into rural areas.



Nature of the Fund subsidy

The UAF funding concept is one of ‘smart subsidy’ or ‘smart incentive’. This is part of a broader approach to government subsidies known as Output-Based Aid (OBA). The OBA approach delegates service delivery to the for-profit or non-profit private sector under contracts that tie payments to the outputs or results actually delivered to target beneficiaries.¹⁰ Long-term sustainability of the service is the objective, and the subsidy is given only once. It is recognised that a financial enticement is required to invest in difficult areas, but the once-only subsidy is offered to meet whatever capital and operating shortfall is required to carry the investment from loss-making to the point of viability and acceptable rate of return. The operator is expected to meet the roll-out obligations spelled out in the bidding documents and in the license, to provide a stipulated quality of service and to develop the business in a self-sustaining manner, free of further subsidies. The operator is usually not granted exclusivity, only the benefit of being ‘first in’ to a territory that is unlikely to attract other entrants for some time.

2.6 Experience with funds: Success factors & pitfalls to avoid¹¹

Since the first developing country fund was established in the mid-1990’s, approximately 20,000 communities have received telephone service through UAF mechanisms in five countries. More than ten rural operators have been licensed, with subsidies given as summarised in the following table. Several other Latin American countries are planning UAFs. In Asia, only Nepal has any experience to date and this is very limited, while Uganda’s will be the first experience of a broad-based fund with open bidding in Africa.

The table shows that various sources are used for Fund finance, including direct Government contribution, a levy on operators, or radio license fees. *In most cases the amount of subsidy actually bid and granted was much less than the maximum offered by the funds. Also, the Funds have all leveraged much more private sector investment than the subsidies given. For example, in Chile that ratio was overall approximately 20:1.* However, the table averages hide a wide range of experiences, from zero subsidies in some of the early Chilean competitions to 100% of the offered amount in later rounds.

Country	Name	Source of Finance	Period	Localities served	Max. subsidy available (US\$ M)	Subsidy granted (US\$ M)	Subsidy per locality (US\$)
Chile	Fondo de Desarrollo de las Telecomunicaciones	Government budget	1995-97	4,504	24.2	10.2	2,256
			1998-99	1,412	14.4	9.8	6,919
			2000	143	1.9	1.8	12,727
Peru	Fondo de Inversión en Telecomunicaciones (FITEL)	1% Operator levy	1998	213	4.0	1.7	18,800
			1999	1,937	50.0	11.0	5,700
			2000	2,290	59.5	27.8	12,100
Colombia	Fondo de Comunicaciones (Compartel)	Operator levy & Government contribution	1999	6,865	70.6	31.8	4,600
Guatemala	Fondo para el Desarrollo de la Telefonía (FONDETEL)	Spectrum auctions	1998	202	N/A	1.5	7,587
			1999 (2)	1,051	N/A	4.5	4,282
Dominican Rep.	Fondo de Desarrollo de las Telecomunicaciones (FDT)	2% Operator levy	2001	500	3.8	3.4	6,800

¹⁰ See for details “Contracting for public services: Output-based aid and its applications” Edited by Penelope J. Brook and Suzanne M. Smith, published by Rapid Response Unit of the World Bank Group.

¹¹ Much of this section was written for a World Bank Viewpoint article (to be published) entitled “Rural Telecommunications in a liberalising environment: An update on Universal Access Funds”, by Andrew Dymond and Sonja Oestmann



An important lesson is that the successes appear to be due to a combination of careful fund design and supportive regulation. On the other hand, all potential problem areas could not be anticipated or fully addressed in advance. Some of the challenges have arisen largely due to international market factors and issues or failures encountered by licensees that, while beyond the control of governments and regulators, must also be taken into account by regulators and Fund designers.

Most of the Funds have achieved the access targets set by Government. The key lessons are the following:

- **The fund and licence design needs to take into account the strategic interests of potential bidders** – Competition between incumbents wishing to secure territory and new entrants gaining a foothold in the market place have made the funds a success in the majority of cases. The first one or two rounds in each country were the most hotly contested because they involved bidders' strategic interests. The Funds were able to maximise interest and minimise subsidies through designing licences that were flexible enough to suit new entrants' and incumbents' strategic interests alike, i.e. they created several geographical licenses and allowed operators to select according to their interests. Operators were allowed to bid for single licences close to their existing coverage as well as multiple licences assembling territorial blocks. It is also important to design licence areas approx. equally attractive so none is left without a bid (i.e. don't group only the least viable communities together).

In Uganda's RCDF auction, only 154 sub-counties in certain parts of the country – those unserved by the two main operators, Uganda Telecom and MTN – will be offered for competitive bid. The licenses will be offered in up to eight small regional blocks. Operators will be given the option of bidding for any number. It is expected that whereas mobile operators will bid selectively, fixed VSAT based operators may seek to increase their economy of scale by bidding competitively for all together.

- **Bidders respond to competition if there is something attractive on offer** – Bidders for many of the rural payphone licenses have been allowed to also serve other business and residential customers and to propose unregulated services that were added to their licenses and contribute to commercial viability. One wireless operator in Chile that won licenses requiring 1,800 payphones has built an extensive regional network with 18,000 lines. Also bidders get access to frequency spectrum and ideally pay very little for it, otherwise they add spectrum fees to the costs and increase the subsidy amount required. Equally important is to allow bidders to choose the technology to serve communities as freely as possible as this minimises the subsidy requirement if bidders can choose a mix of the most cost-efficient technologies.

Uganda's period of exclusivity over voice telephony will end in 2005. New entrants under the RCDF competitions will be allowed to use any proven technology, to offer voice and data services in their areas, and if they meet the obligations in their designated rural areas will have their foot in the door to expand and to become national operators later.

- **Good regulatory design, including tariff freedom and fair interconnection** – A sound regulatory environment enables the subsidies to be 'smart' in the sense of assisting with start-up of profitable ventures. In the Chilean case, operators are allowed to charge higher tariffs (up to a regulated limit) & the regulator has implemented cost-related asymmetric interconnection rates. The interconnection regime gives rural operators access charges that are several times higher than those of urban operators, based on the fact that the costs of rural networks are much higher than urban ones. This creates significant revenues from incoming call traffic and the incentive to exploit demand for incoming calls. As an example of the impact of this, the largest Chilean rural operator derives 60% of its total revenues from its positive interconnect balance with urban operators, allowing it to recover costs and develop significant business opportunity from incoming calls. Colombia has also implemented a cost-based asymmetric interconnection regime for rural operators and Peru is planning to do so.

Two pillars of Uganda's rural communications development strategy are tariff flexibility and "special rural interconnect", a policy to implement asymmetrical access charges such that operators serving the designated high-cost rural areas will receive higher call termination fees. This will enable and incentivise them to develop the incoming call market – over 80% of rural Ugandans have relatives living in Kampala or overseas, who create a far heavier demand for calls into rural areas than outgoing. UCC plans to use this to encourage operators to offer special incentives for rural payphone retailers to promote incoming call termination.



- **Demand study and clear targets** - Use of rigorous market research and demand analysis in the Fund establishment process is essential for the Fund administrator to identify areas in need of subsidies and to develop a licence and bidding strategy. It also provides helpful assistance to bidders. Most countries provided quite comprehensive data to bidders – in Chile, even specific payphone site locations were identified by local authorities, community associations, other organisations and the public at large (but not prescribed).

The preparation for the Ugandan Fund also included a detailed “Rural ICT Baseline Study” in which the user needs, preferences and demand for all communications services were researched at the community and household level in every region of the country. This determined the level of supply that is demanded, the level of payphone and other ICT placement justified in the Universal access strategy, how the markets will develop, and which areas the Fund will need to focus on. This data has already been made available to existing operators, as stakeholders in the development of the country, and will also be made available to new bidders in the auction process.

2.7 UAF beyond basic telephony

The attention of several funds includes extending Internet access and advanced services, either as the next objective after telephony targets have been met or as a complementary goal. Three funds have implemented Internet access or telecentre/ infocentre programs so far: in Latin America the Colombian and Chilean programs, and the Universal Service Fund administered by the Universal Service Agency (USA) in South Africa. A few other funds are planning to include support for Internet points-of-presence or telecentres (e.g. Uganda, Dominican Republic and Bolivia). Peru's FITEL is also financing pilot projects involving the Internet.

Lessons thus far are drawn from telecentre projects in general and specifically from South Africa's USA first round of experience, which has implemented telecentres from as early as 1998. Promising ideas are also emerging from Chile's and Colombia's program, which has commenced very recently.¹² Various sources agree that only a few of the 90 or so South African telecentres supported by the USA are financially self-sustaining after the initial funding; a significant number are in serious trouble or have effectively closed. Even the best cases, e.g. Gaseleka¹³, typically do not cover equipment depreciation and are therefore not self-sustainable in the long run without ongoing external support. The experience is similar to that of telecentres elsewhere, unrelated to Funds. However, well-managed telecentres with a variety of ICT enabled value-added services can have a high level of impact and be of tremendous benefit to rural and low-income communities. That is why the interest in them is justified.

Latest thinking is that, for most countries, telecentres need to be commercial, predominantly small-scale and led by entrepreneurs, in order to ensure sustainability and proliferation. Developing countries simply do not have sufficient resources to support a large number of multi-purpose telecentres on an ongoing basis. However, to date very few projects have been set-up on a commercial basis; for example, community-based organisations or NGOs sponsor most of South Africa's telecentres. *Colombia is the first fund to successfully implement a competitive bidding scheme for private operators, allowing economies of scale by bidding telecentres in the hundreds. This will facilitate telecentres to be run by local entrepreneurs in the community but with the support of a network and management organisation.*

Taking the balance of experience thus far, it is clear that policy-makers can support Internet and ICT based service development in a variety of ways, but need to take a step-by-step approach that focuses more on the supporting environment than direct finance. It is important not to distort a just-emerging market, and funding should be limited to the minimum required. The following are the measures needed and it should be noted that only three involve direct financial support.

¹² In late 1999 GVT (Gilat Satellite Networks) won the first Compartel phase to install 6,745 payphones and 670 Internet access points which they completed at the end of 2001. Phase 2 was declared void and in April 2002 Compartel received a sole bid from Gilat for Phase 3 to install 500 community telecentres in a pre-qualification bid. In November 2002 Gilat announced it had won the tender and was in the process of contract finalisation. At end of 2001 Chile awarded subsidies for 55 urban infocentros designed to assist SMEs. A tender for over 100 rural telecentres had been announced in 2002 but there are currently no further news.

¹³ See The Gaseleka Telecentre, Northern Province, South Africa, Peter Benjamin, in Commonwealth of Learning, *Telecentres: Case studies and key issues*, 2001



Internet and ICT service support mechanisms

- Start with removing any barriers to the development of the Internet and ICT services market, such as allowing IP Telephony, nation-wide local call tariffs for Internet dial-up, easy licensing for ISPs, access to (international) bandwidth and promoting national IXP exchanges, etc.;
- Develop public services online (e-government, tele-health, tele-education etc.) and content to create applications and stimulate demand in telecentres;
- Offer subsidies for Internet infrastructure first, e.g. small subsidies to establish Points of Presence (POPs) in every rural district, as planned by the Ugandan fund (see Annex F);
- Support Internet connectivity and PC labs for schools, requiring the schools to cover their operational expenses through opening their facilities during off-hours for wider community access;
- Promotion and awareness creation of telecentres through conferences, workshops and training opportunities for local entrepreneurs;
- Only where the market does not reach commercially, offer support to telecentre start-ups through competitive bidding procedures, following the successful principle and practice of the rural telephony funds; and
- Develop guidelines and requirements that improve the prospects that commercially run telecentres can fulfil the function of assisting rural and low-income communities in their social and economic development.

Clearly, the development of the ICT market and diffusion into rural areas is a complex and multi-faceted exercise that will take time. The general country market aspects are covered further in Chapter 4 and demand evaluation in Chapter 5.

Further information:

- See for selected papers on Universal Service/Access the World Bank Rapid Response Unit, Papers & Links on Investment Climate and Privatization/ Telecommunications/ Universal Service <http://rru.worldbank.org/Resources.asp?results=true&stopicids=60>, in particular:
- Closing the Gap in Access to Rural Communications: Chile 1995-2002, Björn Wellenius, Discussion Paper 430. World Bank, Washington, D.C., February 2002
- Mobile Operators: Their Contribution to Universal Service and Public Access, Sonja Oestmann, Intelcon Research and Consultancy, Vancouver, January 2003
- Rural Telecommunications Development in a Liberalizing Environment: An Update on Universal Access Funds, Andrew Dymond and Sonja Oestmann, Intelcon Research and Consultancy, Vancouver, July 2002



3 UA FUND ADMINISTRATION & OPERATING GUIDELINES

3.1 Fund Administrator

There are two options for which institution should administer the Universal Access Fund and implement its programs and projects: the Ministry in charge of Communications or the National Regulatory Authority (NRA). While there are some funds administered by the Ministry, general consensus is that it is better to be administered by the NRA. The table below gives advantages and disadvantages for the two options.

<i>Administer of UA Fund</i>	<i>Advantages</i>	<i>Disadvantages</i>
Ministry of Communications	Possibly considerable body of expertise Possibly more staff and resources Closer link between policy and implementation	Closer association with current government, not necessarily perceived as objective
National Regulatory Authority (NRA)	Ideally positioned to balance UA policy objectives with needs of communications industry, as NRA's role is usually already that of a 'referee', mediator between individual industry players, and the sector and government/ state-owned incumbent. NRAs are established to be independent entities and are at least one step removed from the Ministry. This allows for a certain independence from political pressures and ability to develop long-term strategies. More familiar with the private industry through day-to-day dealings and experienced in practical regulatory issues rather than high-level policy	In some cases limited capacity, especially if NRA is very new

3.2 Operating Manual & Guidelines

Every Universal Access Fund needs a document which lays down the rules, procedures, principles and guidelines of the how the fund is administered and operated. This is sometimes called a UAF Operating Manual. Below is an example outline from the Ugandan Rural Communications Development Fund (RCDF). However, the manual needs to be adapted for each country, its situation and the particular fund.



BOX 1: UGANDAN RCDF MANUAL OF OPERATING PROCEDURES

1. INTRODUCTION & OBJECTIVES
2. THE UCC POLICY ON RURAL COMMUNICATIONS
 - The General UCC and RCDF Strategy
 - Basic Access and Service Definitions
3. OVERVIEW OF CANDIDATE PROJECTS AND SOURCES OF FINANCE
 - Focus for Priority Projects
 - Sources of Finance available to the RCDF
4. GOVERNANCE, MANAGEMENT & ADMINISTRATION OF THE RCDF
 - General Constitution, Role & Functions
 - RCDF Board, Role of Executive Director
 - RCDF Staff
 - Project outsourcing, Consultants to the RCDF
 - Finances
 - Annual Report
5. THE FUND PROGRAM & PROJECT SELECTION CRITERIA
 - The Fund programme
 - General disbursement priorities
 - Prioritisation of projects & locations
 - Subsidy strategy & calculation methodology
6. TENDERING PROJECTS & SELECTION OF RECIPIENTS
 - General
 - Pilot funding procedures
 - Level 1 Tendering Procedure – Open tender for public telephony, total subsidy above \$100,000
 - Level 1 Tendering Procedure – Open tender, telephony or Internet, total subsidy below \$100,000
 - Level 1 Tendering Procedure – Outsourcing for disbursement of small-scale amounts
 - Level 1 Tendering Procedure – Open tender for support of district-level ICT projects
 - Level 1 Tendering Procedure – Direct disbursement for grants of less than \$1,000
7. RCDF SUBSIDY DISBURSEMENT PROCEDURES
 - General
 - Telephone license projects
 - Internet POP, ICT and bulk purchase projects
 - 'Rural package' contracts
8. ROLE OF UCC IN RURAL OPERATOR REGULATION
 - General license conditions
 - Special rural interconnect
 - Numbering Plan
 - Customer tariffs
 - Radio Frequency issues
 - Community participation in public phone development
 - Public telephone and telecentre management training
 - Performance monitoring, Penalties & Enforcement



3.3 Key principles

Accountability

One of the most important principles of any UAF is proper financial management and accountability. Therefore there are several requirements in place for administering the UAF that safeguard the financial integrity of the UAF, as follows:

- **Separate accounting:** While the UAF administration is located within the NRA, it should be set-up as a separate unit with separate operating budget and accounting for all its costs, e.g. administrative and personnel costs. This also requires separate bank accounts with the UAF as the sole authorised user.
- **The UAF requires specific rules for its management and staff on procurement, accounting standards and procedures, and accountability regulation in case those are not followed.**
- **Public Annual Report:** The UAF management is required to publish an Annual Report, reporting on its activities, its levies collected from the operators and service providers, any other funds received, its disbursements and its costs.
- **Independent auditing:** Annually the UAF finances and accounts should be audited by an independent and reputable accounting firm. This should be made public as well.

Impartiality & transparency

Another key for a successful fund is that the UAF administration has and creates trust in its impartiality within the industry and other stakeholders, and that it conducts its business justly and fairly, without favouring any particular player. The following institution ensures this:

- **Special Board for UAF.** Whereas the regulator and the UAF administration sets the directives for the UAF goals, management and project implementation, every UAF should have a special UAF Board. Its role is advisory as well as monitoring. The Board should include representation from the communications industry (not locally active), the consumers, the financial sector, the Ministry of Communications and other stakeholders and experts as appropriate. Board Members need to declare that they do not have any financial interests in service providers applying/bidding for subsidies, or any other conflict of interests.

Efficiency

Last but not least, a UAF administration needs to be effective and efficient. This requires at least:

- Sufficient enforcement and dispute resolution powers
- Management autonomy
- Sufficient financial and human resources

Further information:

- ITU & CTO Model Universal Service/Access Policies, Regulations and Procedures, Part 1: Universal Service/Access Policy, and Creation and Operation of Universal Service Funds, Draft 26/11/02, Prepared by David N. Townshend



4 COUNTRY MARKET SITUATIONS

Overview: This section attempts to fulfil several purposes: it gives governments an overview of how to take stock of the current situation and a structure for ICT market development which is aimed to assist with development of appropriate UA targets and assessment of the current market reach. It also addresses how investors/businesses and donors can go about developing projects and business opportunities in a given environment. An understanding of how to work within constrained circumstances and also how to develop projects which enable countries to take significant steps towards better infrastructure and effective ICT projects is important. This Chapter provides a simple understanding and guide to that end.

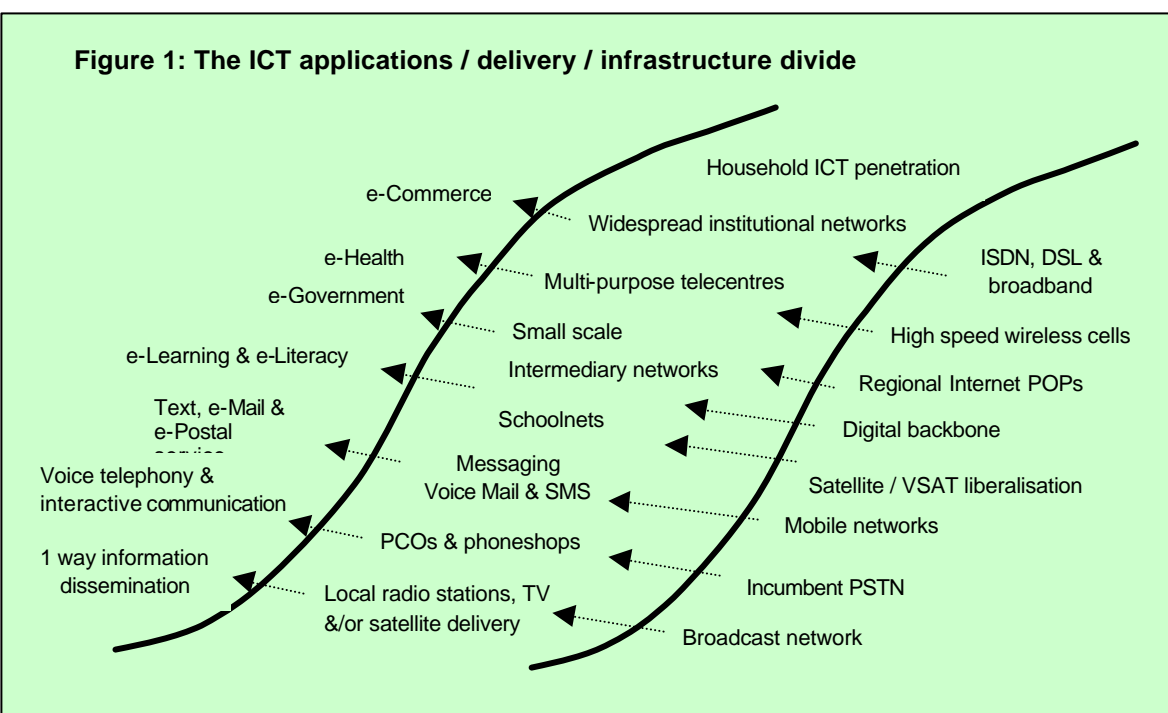
4.1 A structure for ICT market development

Information and Communications Technology of course encompasses a wide range of infrastructure, services, content and applications, with many inter-dependent parts.

The ICT term has shifted from being a catch-all phrase for the numerous *technologies* involved into a term encompassing also all of the communication and information *applications* and *services* enabled through the technologies. The diagram in Figure 1 provides a structure in which to view:

- a) the underlying telecom & Internet infrastructure,
- b) the access/delivery modes, and
- c) the demanded content, applications and services.

Within each category, the hierarchy of ICT development is shown to follow more or less the common market take-up curve; the logical development is thus from bottom left to top right. However, the *dependency* of the services on the available access modes, or of the access modes on the underlying infrastructure must be understood in a right-to-left direction, as shown by the arrows. In general, each element is dependent on other elements being in place below and to the right.



The diagram is geared to the rural African setting, where *public access* to a basic range of applications and services will be more realistic initially than the achievement of advanced ICT at the household level. Also, within the infrastructure stream (right hand curve), mobile networks and satellite are shown before a digital backbone because this is the way many African countries' infrastructures are developing, even if only temporarily in that order, whereas in advanced countries the reverse has been true¹⁴.

4.2 Guidelines for identifying & developing ICT projects & opportunities

Rural ICT programs and projects for African countries (whether business or donor-led, or undertaken by government) need to take into consideration the existing infrastructure situation, market structure and policy stage. Projects should be tailored to the available infrastructure and its most realistic 'next steps', given each country's policy plans and market players. Implementation of advanced ICT services in country regions and areas that do not have the necessary underlying basic infrastructure could have little beneficial impact or possible upgradeability, and at worst become a waste of resources. Understanding where each country is on the curve of the diagram enables identification of existing potential which can be realised fast, as well as where support should be targeted to have the most impact.

To identify feasible ICT projects in a country and to develop appropriate UA targets and possible development strategies the following steps need to be taken and questions answered:

1. Current infrastructure

A review is required of the existing infrastructure that reaches rural areas in a particular country today. Knowing the status of rural infrastructure allows us to understand what services and applications it can support as well as feasible upgrade possibilities, alternatives and potential for leveraging that existing technology for new types of services. For example, countries with rapidly increasing mobile coverage, but no appreciable public access vehicles (PCOs or phone shops) outside towns, may be prime candidates for policies and/or financial programs focusing on the establishment of phone shops and franchise-like networks. A program could focus on bringing together partners to develop the public access business, possibly in partnership with the mobile operators. Or if a country has a reasonable digital backbone, facilitating Internet POPs in key regional centres could be the next step, enabling leading schools, intermediary agencies, local government and businesses to get onto the net (see Annex F for illustration).

2. Policy situation and plans

It is also necessary to thoroughly review the current policy and regulatory framework incl. issues such as tariff policy, spectrum allocation, licensing and liberalisation among many others. In addition, developing a clear view of what likely policy changes can be expected in the short-to-medium term is necessary too, as they determine what infrastructure development and service provision are available in the near future which could be leveraged for rural ICT projects. If for example the fixed (PSTN) telecom infrastructure is inadequate for widespread Internet deployment beyond main cities, then the technical options, short of building a completely new backbone, involve either 'piggy-backing' on a mobile network's backbone¹⁵ or use of satellite. The country's regulatory stance on satellite transmission, and specifically VSATs, may be critical to the widespread deployment of Internet points-of-presence beyond the reach of the PSTN or mobile network.

¹⁴ Importantly, GSM mobile infrastructures are fundamentally digital and tend to create the same backbone requirements as a fixed network (i.e. they expand from the main cities to regional centres, then to district centres, etc.). Hence there is not necessarily a conflict with mobile network leading fixed network development, so long as planners have enough foresight to integrate or facilitate other forms of demand for fixed or semi-fixed services (e.g. regional switches and ISP routers, high-speed wireless access systems, etc.) at the base station sites.

¹⁵ Mobile base station towers as the focal points for high speed fixed wireless access centred on Internet POPs (e.g. at district centres) and thus institutions and businesses within line-of-sight of a mobile base station could be provided with a direct Internet connection.



3. Market players & stakeholders

In addition, it is recommended to interview the existing telecommunications and Internet infrastructure and service provider in a country, about their expansion plans (to rural areas) and view of the rural markets. This often reveals potential opportunities to work together to expand networks and services. 'Market players' also include non-ICT players that have a (potential) interest in rural areas, be it commercial or development focussed. For example, if a country has an active health NGO wanting to reach the rural population, it could use a combination of a FM radio station for information dissemination and adding call centre and information retrieval services for call-in and 'question and answer' services. This would add to the demand for private and public access telephony and messaging services. Or, if a country has a good banking/credit system and an existing bank is interested in servicing the demand for financial remittance transfer to rural areas, this could open up a feasible project to bring some e-banking solutions to rural areas.

In some countries, the situation may require concentration mostly on one type of development for a while. In many countries, developments can take place at several levels simultaneously. However, it is essential for any ICT project and/or ICT development program to undertake a thorough review of the status quo as well as near-future plans in regards to existing infrastructure, policy and market players. Only this allows tailoring feasible ICT projects or appropriate UA targets for that country that build on the existing strength and potential of a country and leverages the capacities and synergies of market players and stakeholders already active in the market.

4.3 Initial approximation model to indicate viable and non-viable areas, and maximum subsidy required

This model is for basic telecommunications only, as that is still the key need in rural Africa. The "maximum allowable subsidy" is the amount an operator will likely require to provide the minimum stipulated level of public telephone service to the target area, using minimum cost technology.

For every area to receive service through the UAF, the expected public telephone revenue and costs to supply service must be estimated, submitting these to a "viability test" which calculates the likely maximum one-time subsidy an operator would require to provide service in a commercially sustainable manner.

It is recommended that this exercise should be undertaken by means of a spreadsheet model that summarises certain key data for each administrative area (e.g. district, sub-county, local government authority) under consideration for subsidy under the UAF program.

Revenues

The revenue estimate must take into consideration the following:

- Population (p)
- Local/rural per capita GDP (i), estimated either as:
 - the average of the lower deciles of regional income distribution – corresponding to the proportion of the population who are rural (this assumes that the rural population is generally lower income than urban), or
 - an average for the area, from district GDP (e.g. using UNDP data).
- An expenditure factor (e), which is the % of income spent on telecommunications. This can be taken as the national average of the respective country.
- An "access distance factor", which is the proportion of rural population (or revenue potential) which will be reached by public pay telephones. Estimations for this factor can be made from a consideration of the average travelling distance for users – e.g. halfway between the



extremity of the area and the central trading centre. The relationship is “inverse”, such as $1/d^x$, where x is less than 1 and d is the average walking distance.¹⁶

- No. of payphones (n), based on a population figure to be the desired UA target (e.g. one per 5,000 people). A square root relationship is used between achievable revenue and the number of payphones, reflecting the fact that the proportion of revenue captured by the first telephone is larger than subsequent ones. [The combination of (d) and (n) may together yield a combined achievable fraction of market achievable by public payphones in each area, and should typically range between 25% and 75%.]

The potential revenue projection from payphones can thus be estimated as follows:

$$R = p \times i \times e \times 1/d^{0.8} \times n^{0.5}$$

Costs

The cost of supplying service should be estimated using the dominant technology utilised by existing operators. This assumes that existing operators will be interested in expanding into the new areas. This will also normally represent the cost ceiling, since alternative technologies, whether selected by the major operators or new entrants, would generally need to be less expensive to be considered competitive solutions.

The simplest cost estimation methodology calculates the number of GSM or other wireless base stations required to cover the areas under consideration, using a standard ‘ideal coverage radius’ (e.g. 35 Km) modified by a ‘terrain factor’ which reduces the effective radius that can be covered due to hills, mountains or other terrain considerations known to exist in the area. The terrain factor would be 100% for ideal radio transmission territory, but almost always less than this (e.g. between 25-75%).

Subsidy estimation

The maximum subsidy requirement may be calculated in one of two ways¹⁷:

- Calculate a 10-year cash flow for each service area, showing revenue (with an allowance for growth over the cash flow period), capital and operating costs, and estimate the net present value using an assumed cost of capital as the discount rate. If the NPV is negative, this will represent the maximum subsidy required by the operator to provide service in a commercially viable manner. [If the NPV is positive, this indicates that no subsidy may be required, although it will be necessary to investigate alternative revenue and cost assumptions to determine the robustness of the calculation.]
- Make a basic “benchmark calculation” that assumes a standard pay-back period of capital cost from revenues (e.g. two years) to be typical for private high-risk rural telecommunications investments. This will indicate whether, and by how much, the revenues fall short of providing the operator with an acceptable rate of return. The following table illustrates this methodology using the revenue and cost calculation methods described above.

Factor ->	Geog. area	Distance (d) outer to central point	Rural population	Target no. Payphones (n)	Per capita income	Potential expenditure on telecoms	Distance access factor	Multi-phone multiplier	Base station cost factor	Total capex assuming terrain factor	Capital Recovery against benchmark	Subsidy required
Unit / benchmark ->	Sq. Km	Km		5,000	\$	2.0%	$d^{0.8}$	$n^{0.7}$	\$300,000	33%	0.50	\$
				per phone					per BTS		(2 yr payback)	
Local Area 1	1,000	18	16,500	4	300	99,000	0.174	2.64	0.26	236,192	84%	48,510
Local Area 2	1450	21	11,700	3	270	63,180	0.150	2.16	0.38	342,478	37%	189,313
Local Area 3	630	14	21,400	5	350	149,800	0.209	3.09	0.16	148,801	201%	0

¹⁶ Although the *principle* is sound and intuitively rational, there are no major research resources to establish the value of x . The value of x is therefore set subjectively, to achieve results that are supportable from experience.

¹⁷ Both require significant assumptions, e.g. cost of supply (which can vary a great deal depending on the operator's total traffic capacity assumptions), required rate of return, pay-back period, hence there is not much to choose between these methodologies, except that the second methodology is easier for a first approximation.



Either of the above methodologies provides a first estimate the maximum subsidy required, though option 2 is simpler. In any case, the methodology should provide an estimate of the *maximum* required subsidy, for the following reasons:

- The assumption that public payphones will be the prime instrument for securing potential revenue is pessimistic. In the event an operator uses the same infrastructure to provide private services also (e.g. mobile service, etc.), significantly more revenue could be available from the private customers, even if less of the total market would be attributed to the public phones. In this event, the final revenue may be significantly higher than that calculated.
- The revenues are based on local (rural) affordability. It does not account for incoming call revenue from urban customers calling their rural relatives and friends. Especially with an asymmetric cost-based interconnect agreement in place this could provide more revenue than from the outgoing calls.



5 MARKET DYNAMICS & DEMAND ANALYSIS

Overview: A crucial step and element of developing a rural ICT project or program is obviously to identify the demand and needs of the rural community for which the project is intended. In terms of sequencing the project development process, this step should be taken after the high-level review of the country market situation. This chapter outlines the basics of rural telecommunications and ICT demand.

A complete demand study includes both desk and field components, which are described here. Using fundamental socio-economic and demographic statistics, projections of potential demand are made, followed by a baseline study carried out in the field. The field study confirms user needs, preferences, demand and affordability. The field study methodology and questionnaires can also include the research for a socio-economic impact analysis, as discussed in Chapter 8.

5.1 The rural market place

All ICT projects exist in a market place, therefore issues of need and application, demand, affordability, willingness to pay, awareness creation, advertising, competition, regulation, and the growth of all of these must be considered in detail.

The factors that together create and sustain a market derive fundamentally from the nature of an area's or country's economy and from its socio-economic, demographic and cultural make-up. Geographical factors – in particular, size, topography and population density - also play an important role in defining how viable a 'market' is as a commercially interesting or sustainable opportunity for ICT projects.

This section provides guidance as to how an area should be profiled and characterised for ICT potential, demand and viability.

Telecommunications and more advanced (non voice) ICT may need to be analysed separately or uniquely, however it is important to combine the thinking about both voice and non-voice in the data collection stage.

5.2 Rural telecommunications fundamentals

Before we describe the methods and tools to estimate demand in rural areas, it is important to describe a few key features of rural telecommunications and ICT as they differ from urban ICT.

Public access

In the past rural telecommunications has been often considered unviable, but this was usually based on fixed telecommunications networks and the assumption that telephone lines are provided on an individual household basis. And what the individual household could afford to spend annually was usually well below the costs of installing a line in sparsely populated rural areas. Today it is accepted practice to provide public access telephones, a payphone or phone-shop shared and used by a larger community of users, e.g. a village. The advantages are obvious: the revenue is concentrated on a single line or on a single end-user terminal, making the installation more economical for the operator and cost-effective for the users.

This is important, as it is not individual demand that needs to be the outcome of the demand study, but the collective demand of a certain defined user community.

As a public access telephone should be able to capture the demand of a community, issues of where to locate the phone and how to operate the phone are much more important, in order to



achieve the highest accessibility. There have been examples in the past (e.g. in India) where the public telephone was placed in the office of the local administrator. This is not a good choice as it prevents many people from using the phone due to social barriers (especially in a caste society such as India). In addition, an administrative office is only a limited number of hours open to the public.

Many advantages speak for the phone shop model in developing countries, as opposed to an unmanned payphone booth. This includes that the phone shop owner can assist first-time users or illiterate users, less logistical issues with coin collection or phone-card distribution, the owner can perform simple trouble-shooting and provides security for the phone installation, among others. One disadvantage is that the shop is not open 24 hours per day.

Incoming calls and interconnection revenue

For rural telecommunications, it must be recognised that perhaps more than 50% of the operator's potential revenue could come from incoming (i.e. urban to rural) calls. There is a considerable demand in urban areas *to call into rural areas*, usually from relatives and friends who moved to the city. Those are typically also the *more affluent* telephone users. Data in Latin America, for example in Chile, demonstrate that rural operators earn over 60% on their revenue from incoming calls to rural areas.¹⁸ This pattern has also existed in other countries and could become a general rule in low-income countries and areas. Thus, a demand study, which only looks at the affordability *in* rural areas and does not estimate the demand for calls *into* rural areas, will overlook a huge potential for revenue generation by the rural network, as well as overestimate the subsidy required. Most rural people have family members or close associates in the city or overseas and these urban-dwellers have more affordability and also a willingness to call or accept charges.

As a result, there is a major potential for the supplier of rural telecommunications service to secure revenue that actually originates in urban centres. This means that the actual revenue potential for the telecommunications operators could exceed what the rural community is able to spend. If an operator is both the originator and terminator of these calls, it should account for the calls properly and recognise the added benefit received from installing rural networks.

Also, schemes to incentivise the retailers/minders of public payphones (e.g. in PCOs, tele-kiosks, phone shops. etc.) to welcome incoming calls – rather than treat them as an annoyance - take messages, set up return calls, etc, could greatly enhance the operator's revenue stream (as well as the kiosk owner's business). This could make the difference between non-viability and viability of rural networks. Experiments with virtual voice-mail, where rural users can subscribe to their own voice-mail for a monthly fee, similar to having a P.O. box, are particularly promising.

Operators who serve only the rural areas can also derive huge benefit from incoming calls to their area if they receive payment from urban based operators for terminating the calls. Since there could be more incoming than outgoing calls, their source of revenue from this could be greater than the revenues collected from rural callers. This inter-operator payment is called an interconnection fee or 'access charge'. Few countries in Africa yet recognise the importance of this or enforce fair compensation to rural operators for it in their regulatory regime. However, this is one fundamental area of policy that must change in order to encourage rural networks to proliferate. The rural networks would be *much* more viable if this simple principle of interconnection payment was implemented. Furthermore, the per-minute access charges justified in the urban-to-rural direction can be higher than in the rural-to-urban direction. If cost based interconnection were implemented, we could see a very different form of project justification and viability scenario for rural telecommunications than hitherto.

Rural traffic patterns

Another characteristic related to traffic is that rural people more often make (or receive) long-distance calls, for example to the next district centre or to the capital. Especially in Africa it can be expected that almost all calls are to persons outside of the village based on the assumptions that the majority of rural villagers does not have an individual phone to be called on, and will use an

¹⁸ Bjoern Wellenius, "Closing the Rural Communications Access Gap: Chile 1995-2002"



available public payphone. Also, as the affordability is still low, rural villagers can be expected to walk short distances (e.g. to a neighbouring village) to save spending the money on a call. Only for larger distances the cost-benefit ratio of travel vs communication reverses and makes the call more cost-efficient.

In general, rural users are thus to gain from tariff rebalancing which reduces long-distance rates and increases local call rates.

With the above in mind, there might be some scope of improving the affordability of communications for rural areas by a considered design of local calling areas mindful of demographics and communities of interest rather than to geography alone.

5.3 Identifying demand

Demand studies start from very cursory or preliminary desk studies to more detailed ones, and then to sample field studies and to full-scale representative baseline demand studies. These have several levels of depth and accuracy. The voice telephony market can be profiled roughly in terms of demand for private lines, demand for calls from public phones, total revenue potential, costs, and profitability (or not) of the supply business.

Desk studies

The simplest initial estimate can be made in terms of the call-generating and purchasing power of population clusters above a certain size or within given geographical radii.

The demand for telephone service has been identified at somewhere between 1-3% of a community's total income (i.e. per capita income x population, or household income x no. of households) no matter what level of income a community enjoys. People want and need to communicate and are prepared to pay for it. The benefits they receive for their expenditure are to be in touch for family, business or emergency purposes and to save time and expense (the 'opportunity cost') of alternative means of communications such as travelling to a distant location. Whereas the actual percentage of disposable income they are willing to spend varies from country to country, a good rule of thumb is 2%.

More detailed desk studies start with comprehensive collection and analysis of demographic & socio-economic statistical data, including but not limited to:

- population density and distribution
- income levels and distribution
- nature of economic activities and major sources of income
- cultural and linguistic diversity (e.g. indigenous groups)
- terrain (rugged mountains, lowland plains, etc)
- availability of basic infrastructure such as power, transportation and postal services
- distance (proximity) to secondary infrastructure such as ports, restaurants, lodging, fuel outlets and construction contractors
- distribution of important potential users such as local governments/administration, schools, health-centres, businesses, NGOs, etc.

The analysis provides an understanding and description of the country's geographic zones, regions, administrative departments, municipal units and other population centres. The output should be both descriptive and tabular to assist comparative demand analysis and classification of the country's regions, villages etc. and their possession of population, industry, roads, electricity, hospitals, schools and telecommunications.

The likely demand can be projected by identifying the towns and village locations, hierarchical status, general economic activities, populations and estimated income status.



Non-voice ICTs

To this point, there is no such clear-cut demand and revenue stream, that can be identified from non-voice communication, even though there could be significant market in the medium term. The fact of the matter is that even urban based Internet Service Providers and applications businesses (information, education, or e-commerce) are finding it difficult to estimate their market and meet targets without risk.

The AC Rural ICT Program recognises this fact by noting that the need, demand and application for ICTs in rural areas of Africa can be characterised as follows:

- Basic voice telephony by the majority of the population, and
- Non-voice ICT networks and services at intermediary agencies with active interests, responsibilities and activities in rural areas. These are local government agencies, social infrastructure and health institutions, schools, NGOs and some business entrepreneurs.

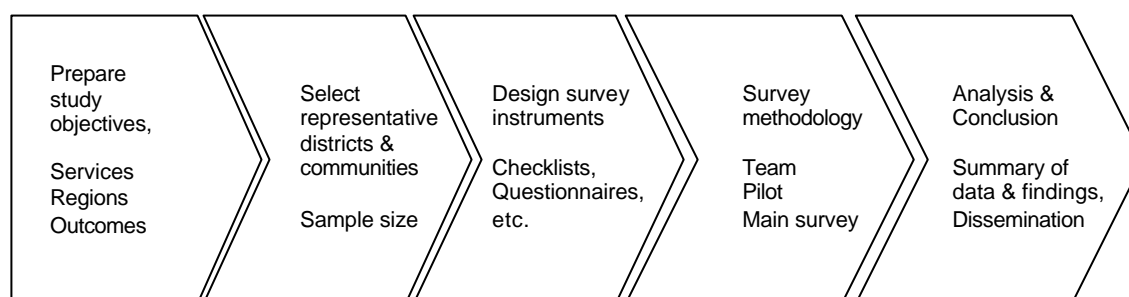
With the exception of some of the more 'advanced' or 'vanguard' rural based agencies or units, the vast majority of the intermediary agency offices with demand for non-voice ICTs today are based in regional or district centres and/or other small towns, but usually not in villages, even though many of their 'clients' are villagers and villagers may visit their offices often.

Thus the potential user community and 'demand' for more advanced ICT has to be identified in a more consultative fashion than for telephony and often involves more than simple identification of demand. It includes consideration of how to catalyse partnerships between development, administrative and private agencies to create sustainable and scalable ICT demand. The process typically includes the following:

- through desk research, stakeholder consultation and consensual analysis, identify the type of agencies, institutional units, associations and individual small-micro-medium enterprises (SMMEs) that are the most likely to become users of ICT, based on current activity and interest, development programs, state of finances & economy, etc.
- identify the distribution and size of these institutions and units (i.e. local government, hospitals and clinics, schools, NGOs, business and/or agricultural associations, micro-finance offices, etc.) and profile potential requirements
- carry out a field survey as a 'reality check' to identify what the real potential, ability to absorb investment and use of the technology will be, and what form of partnerships may be required
- identify the centres – e.g. district centres, small towns, etc. - where Internet points of presence will best serve the 'demand'
- coordinate with specific data for ICT deployment coming from other sector players
- harmonise the data into realistic (and not over-optimistic) demand approximations.

5.4 Field studies

Based on the project type under consideration, a formal field demand study is designed for telephony, non-voice ICT, or both. Usually a demand expert designs the survey with the assistance and active collaboration of a local research institution (e.g. university social research department or institute). The following diagram shows the various steps of a field study. A field study should always be based on a prior desk study.



Study objectives

The field survey is usually designed to identify both user needs/preferences and ability to pay, with explicit links made to estimates of income and expenditures. Study objectives should spell out what concrete services are investigated, the target group, and for what purposes the study is conducted, and whether socio-economic impact elements are to be included.

Selection of representative districts and communities

A good and careful selection of provinces, district and communities to study will minimise the need for a large sample. Even if desirable, fully statistically representative field studies are largely expensive and time consuming, and in most cases their level of accuracy is not really required.

Based on the earlier desk-study, the following criteria and questions should guide the selection of a representative sample:

- Does the sample cover all typical or key provinces? (if province A is very similar to province B, B does not necessarily be studied)
- Does the sample cover typical sizes of villages?
- Does the sample cover both areas with ICT services and areas without?
- Does the sample cover various economic situations (e.g. poor village to more affluent villages)?
- Does the sample cover different population densities and terrain (e.g. remote and sparsely populated, more densely populated, mountainous or plains, etc.)

If the sample contains a wide range of different communities and control groups (e.g. poor village with telephone, poor village without, large village in province A, large village in province B), demand can be more easily extrapolated.

Development of a questionnaire

Depending on which type of demand needs to be investigated, the questionnaire instruments need to be tailored to the following target groups and variables:

User types/ situations

- Household user
- Business user (incl. definition of what that is in the rural context)
- Institutional user
- Public phone user

This needs to be further distinguished between interviewing existing users in areas where people have access to telecommunications, and potential users where there is no access. Demand studies always should include a control group of areas that have access to the telephone or other ICT services, if existent. Thus actual existing demand, usage and willingness to pay can be measured. The questionnaire should cover as a minimum the following topics:

Demand Topics:

- Current phone availability
- Phone usage (frequency, purpose, duration, spending etc.)
- Satisfaction and quality of existent services
- Services desired (incl. interest in voice-mail boxes)
- Price perceptions, affordability and willingness to pay
- Possibility of *incoming calls*
- Costs incurred through having no access to telephone (e.g. travel)
- Current alternatives: Postal services, HF radio etc.

The following characteristics of interviewees and locations should be recorded:



Demographics of respondent

- Age
- Family situation
- Occupation
- Education
- Language
- Income

Key information on village

- other infrastructure (how connected or how remote is village?)
- business structure (retail, agriculture trade, animals, markets, etc)
- dominant economic activity
- if agriculture, main crops
- existing institutions in villages (schools, doctor, etc.)
- average household income

Socio-economic impact (if required – see Chapter 7)

- current communication patterns
- alternative means of communication in absence of phone
- cost of the alternative means of communication
- perceived impacts on business and personal affairs
- travel cost savings from use of phone or information services
- other savings or benefits and their valuation

[Note - Sample field-proven questionnaires can be added as annexes in the final Toolkit version if required]

Survey methodology

An initial pilot survey is recommended to give the survey team a test-run and refine the methodology and survey instruments, before the main research.

The methodology and survey instruments can include a mix of:

Key Informants - Several key informants should be selected during the survey, on the basis of their overall knowledge of the area and level of expertise and experience in the field of communications and possible use of ICT, and their representation of key priority customer categories. Key informants can provide considerable qualitative information about the area, economy, local village life etc. These can include:

- Provincial and district administration officials
- Representatives of health centres, schools, etc.
- Community level leaders/Headmen/Business/Phone operators/NGOs, etc
- Local representatives of service providers (where relevant)

Household Survey – A stratified random sample of a significant number of households in each community surveyed. An interviewer administered questionnaire with both closed and open-ended questions should be used to solicit responses from both male and female heads of households.

Rapid community market assessment – comprises a counting of key administrative and social infrastructure institutions, businesses, households, market(s), ‘tea houses’ and other key social collection points, transportation facilities, etc. which generate demand or locations for public access, leading to sampling of some of these and to ‘focus group discussions’.

Focus Group Discussions - Several open interviews should be conducted for purposes of generating a discussion around some of the key hypotheses and findings of the survey. Participants should be drawn from within the target communities, but leaving out individuals that would have participated in filling in the questionnaires. Special attention should be paid to



variations in the socio-economic characteristics of participants and actual access and utilisation of telecommunication services. The actual distribution could be categorised as follows:

- Primary school going youth
- Secondary school going youth
- Youth out of school
- Adult women
- Adult men
- Payphone users
- Mobile phone ownership
- Private line ownership

Analysis and conclusions

The final output of the demand study will typically provide conclusions such as:

- Indications of the number of payphones that could be successful per community or neighbourhood – population size to support each payphone
- Where payphones should be located (e.g trading centres, near village admin offices, health centres, etc.)
- Travel distances tolerable for public access
- Preference for mode of public payphone (e.g. manned or unmanned, coin pay, card phone, etc.)
- For manned payphones, what type of proprietor is preferred (e.g shopkeeper, administrative official, school, etc.)
- Potential penetration of private service (fixed or mobile) amongst traders, schools, clinics, admin offices, residences, etc.
- Preference for technology (e.g. fixed versus mobile),
- Knowledge of and interest in voice messaging, 'virtual phone' service, sms text, information services, email, fax, etc.
- Interest in Internet and potential for telecentre service – what communities have sufficient demand or potential businesses to run a centre
- What kind of schools , institutions, associations, business types are ready for Internet
- What partnerships could be forged to stimulate sustainable and scalable demand for Internet and ICT services
- Overall, the composite demand (lines/terminations, traffic and trunk circuit requirements) per community type and therefore best technology design implications will be estimated.

The output of the demand study will thus inform and refine the project design. In turn, demand studies also help to modify previous estimates of cost, revenue and commercial viability, and the amount of subsidy likely to be required/offered per payphone or for the whole license.



6 TECHNOLOGY CHOICE

Overview: This chapter provides a brief introduction to some of the technologies used in rural areas and some of their features, and is by no means exhaustive or prescriptive meant on which technologies to be used in a particular case. However, it describes the more common technologies used for telecommunications networks and ICT end-user devices, and some possibly upcoming technologies in discussion. It identifies key features and relates them to the rural applications, and provides order-of-magnitude costs.

Every technology has its particular application and niche, and the decision which technology is feasible and meets requirements is highly dependent on a set of very particular factors unique to the area of deployment. These range from policy conditions (e.g. what is allowed), geography and topography (e.g. landlocked country, hilly or flat), other available infrastructure (e.g. backbone, power, transport) and population density, to socio-economic conditions and demography (e.g. type of demand and ability to pay). There are no hard and fast rules on which technology, delivery devices and/or support facilities should be used for ICT projects. This can only be established after the careful review of the factors mentioned above in a particular situation.

Further information:

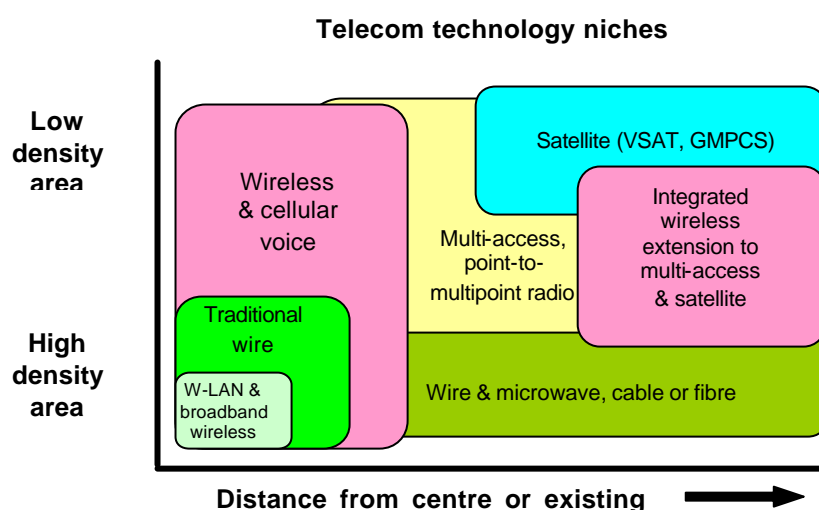
- New Technologies for Rural Applications, Final Report of ITU-D Focus Group 7, 2000
- ITU-R Handbook on Satellite Communications, 3rd edition, 2002
- ITU-R Handbook Land Mobile (including Wireless Access), Volume 1: Fixed Wireless Access, 2nd edition, 2001

6.1 Trends and changing niches

Technological innovation and falling cost trends create a shifting balance of opportunities increasingly dominated by innovative wireless solutions. Which technology is the most cost-effective for a certain region depends to a great extent on:

- distance from the users to the main network
- potential customer/user density, and
- the type of service (e.g. just telephony & fax, or data and Internet also), and
- availability of electric power sources.

The diagram broadly illustrates the typical market niches in just two dimensions, showing the technology most likely to be chosen within the context of varying distances from the main centre or from an existing network (x axis) and varying subscriber densities (y axis).



It will be noted that 'wireless and cellular' and 'integrated wireless extensions' are eating into the market niches formerly dominated by other technologies – for example point-to-multipoint (multi-access) radio. Also because of the unavailability or complex planning process required for fixed lines in many developing countries and the attractiveness of pre-paid mobile, the mobile option is becoming the service of choice, even for a first line, in urban areas. Hence traditional 'techno-economic niches' that might favour traditional fixed-line solutions are becoming less meaningful for new deployment in developing countries. However, fixed line service is still often the technology of choice for Internet access if the lines are available.

The various applications and typical per-line costs to reach rural or poorly served peri-urban areas are summarised in the following table. This can be indicative only, since costs are very dependent on local factors and especially on the availability of a reliable power source.

Technology	Density/ Application	Geography/ Distance from PSTN & issues to consider	Cost range per line (in economic niche) incl. accessories
<i>Wire direct from urban switch</i>	High & clustered (sub-urban or peri-urban communities)	Max 5-10 km radius from exchange Deployment time to outlying areas could be high.	\$250 - \$1,000 depending on distance and level of difficulty. But slow build-out and requires heavy planning, thus increasingly irrelevant in rural areas
<i>Rural exchange or concentrator with wire network</i>	Low/medium & clustered (small town or large village with good affordability). Can extend fixed line data capability	May serve clusters (e.g. 100 subscribers) located more than 10 km from nearest exchange	\$1,000 - \$2,000 including trunk system & building & cable systems
<i>Fixed or mobile cellular</i>	Medium/high density, not clustered, private or payphone, increasingly flexible applications. Limited data capabilities. Most applicable is GSM technology.	Medium area (<35 km radius per cell). Rapid spread can be limited by power availability or by terrain.	\$500 - \$1,500 heavily dependent on terrain and no. of users per cell (e.g. new cell sites can cost \$150,000 – 300,000 each in rural areas)
<i>Wireless-local-loop</i>	Medium/high density, not clustered. Typically licensed for fixed-only or limited mobility applications. Typically 'CDMA' technology.	Depending on frequency, range can be similar to mobile but end-user terminal are higher cost and need fixed power source.	As above, though base station costs are lower.
<i>Multi-access radio</i>	Low density but clustered (e.g. more than 5 users per location). Has advantage of good data capability.	Wide area (radius of several hundred km). Can be enhanced with a wireless 'last mile' to avoid need for cable.	\$1,000 - \$5,000 per line, varies widely with terrain & user 'clustering'. More complex to build than cellular & WLL.
<i>VHF/UHF single links</i>	Low, no clustering & used if no satellite alternative available	Medium-long distance (>25km)	\$10,000 + per circuit if for a small number of users. Limited application.
<i>Satellite VSAT (stand-alone)</i>	Low density, but most economic with some user clustering (e.g. justifying 2-3 lines). Good data capability and also voice/ Internet bundling potential	Very large area, distance insensitive, can cover the whole country from single hub	\$2,000 – 5,000 per line plus \$0.05-0.10/min 'space segment' cost. Individual terminals \$3,000 + power (maybe \$5,000 total). Hub cost \$1 million+
<i>Integrated VSAT/WLL</i>	Low density, but serving larger distant communities or clusters (typically 10-50 lines in vicinity)	Very large area, distance insensitive	\$1,500 - \$3,000 per user plus \$0.05-0.10/min 'space segment'
<i>Mobile satellite (GMPCS)</i>	Low, with no clustering. Limited data capability.	Very large area, distance insensitive	\$1,000 - \$1,500 per handset plus \$0.50/min space segment cost (only feasible for rural telephony where national terrestrial gateway exists)



6.2 Mobile telecommunications – major inroads but not ubiquitous

The wireless explosion – cellular, personal communications and ‘wireless local loop’ systems – are having a spill-over effect on poor urban and rural areas. The number of mobile subscribers is currently growing at 30-50% per annum around the world. This explosion is a direct result of liberalisation of the market, which is usually the first to be freed up. Prices of mobile telephony are tumbling, pre-pay options have reduced the entry price at the lower end of the market, and coverage is often available in areas where the fixed telephone infrastructures are poor. As well, many people now prefer mobile service over fixed, so long as prices are attractive.

In low-income countries, mobile networks can serve formerly unserved areas, including rural and marginal low-income customers, more economically due to certain features of its network economics and operation:

- Within total capacity limits, every additional marginal customer improves the bottom-line, since mobile investment per user is a function of economies of scale. The base-station is a single bulk investment and costs per user decreases continually as more mobile users share the service. In contrast, fixed-line investment can only capture the revenue of a single user unless it is a public payphone.
- In countries with a limited fixed network, the mobile operator is in many areas the “first-in” without competition from fixed services and can capture *all* pent-up demand. Users then often develop preferences for mobile service.
- Additional geographic coverage, outside of cities and along major roads is an important selling point to urban customers who travel throughout the country. Mobile operators often invest in coverage for roaming urban users. Capturing additional rural users is added income.
- The mobile operator can also benefit if the mobile user in rural areas makes only a few calls. It is a well-known fact that urban relatives generate a larger percentage of incoming calls to rural users. Attractive interconnect rates from fixed-to-mobile generate a considerable revenue stream for the mobile operator.
- Pre-paid service eliminates costly customer administration for the mobile operator: there is no credit checking, no billing and no money collection, and no exposure to bad debt.¹⁹ This reduces operating costs considerably, provides cash up-front and the savings can be passed on to the customers.²⁰
- Economies of scale have reduced the cost of base-stations and other cellular infrastructure considerably (far more than for example WLL equipment). In some cases cellular infrastructure is re-used, lowering costs even further.
- A major enhancement of GSM technology for rural areas is the option to implement “range extension”. The reach of a GSM-900 base station can be stretched from its theoretical limit of 35km to 70km, or even as far as 120 km. This is achieved at the expense of cell sector coverage (i.e. the geographical spread of the signal is focused into one direction) and cell capacity (i.e. the number of possible simultaneous conversations in the cell is reduced). In some rural areas, this is a practical and cost-efficient trade-off.

The use of cellular phones as village ‘mobile payphones’ has been clearly demonstrated in Bangladesh, India, Uganda and elsewhere, which illustrates the principle that mobile technology is making a difference to an increasing number of rural areas.

Today GSM mobile is limited in its data capability which is only to some extent mitigated by the development of short-message service (SMS) which can interface with the Internet and offer users access to updated data bases providing a wide range of information. However, the installed

¹⁹ Bad debt is a major cost item for many developing country operators e.g. Telemar in Brasil had bad debt of almost \$67 million just in its third quarter in 2001.

²⁰ Fixed operators seem to have finally caught on to the benefits of pre-paid. Examples of fixed operators having introduced pre-paid recently are N-Soft in Gabon, Brasil Telecom, PLDT in Philippines, Telmex in Mexico and CANTV in Venezuela.



transmission network and the base stations can be used to cost-effectively co-locate high-speed wireless Internet technologies.

6.3 Satellite – Very small aperture terminals (VSATs)

Satellite systems have traditionally been very expensive. Large terrestrial dishes were needed and satellite transmission resources – the ‘space segment’ – unaffordable for all but the largest and most price-insensitive users with critical communications requirements and no alternatives. Subscriber terminals were bulky. During the 1990s, satellite capacity and power has increased substantially, bringing down the cost of the space segment. The size and cost of VSAT hubs and remotes has correspondingly fallen, as has the size and cost of subscriber terminals. These changes have expanded the addressable market for VSAT for voice and data beyond corporates, NGOs and government departments and also expanded the use of VSAT beyond private networks to the PSTN. VSAT systems are now in use for rural telephony in Thailand, South Africa, Ethiopia, Kazakhstan, Chile, Colombia, Peru, Mexico, and others.

VSAT suppliers are interested in deploying hybrid VSAT/wireless networks in scattered rural communities distant from the PSTN, with demand for perhaps 50 or more subscribers per remote, at prices that are competitive with the typical \$1,000 per line of suburban wireless local loop systems. This may serve them more economically than with additional VSATs or installing cables to the nearby terminal. However, whereas talked about, no VSAT system supplier has achieved any significant deployment yet of VSAT integrated with WLL.

Whereas the cost of the electronics can be as low as \$2,000-\$4,000 for small installations involving two or three village phone or fax lines, the final installed system price has a high fixed cost element involving the hub, which manages and controls the entire network. The hub cost, which can be US\$ 1 million, means that economies of scale are large for large systems with several hundred VSAT terminals. VSAT is therefore economical for large rural projects with scattered villages that would be too expensive to connect with wire-based systems, but uneconomic for small projects involving only a few lines per system.

VSAT systems with asymmetric transmission are available that deliver high data rates in the downstream direction (network to the subscriber terminal) and lower speed in the upstream direction (subscriber terminal to network). These systems are useful to provide high-speed Internet access, ecommerce kiosks and telecentres to rural communities, in addition to digital voice telephony and voice over IP.

In summary, VSAT is a viable technology for large projects with a significant number of VSAT terminals in very rural areas where enough demand exists to concentrate traffic on each terminal and ‘average down’ the high cost of the hub. There are only a few major VSAT vendors world-wide: the leading ones are Hughes Network Systems, Gilat Satellite Networks, STM Wireless and ViaSat.

6.4 Mobile Satellite – GMPCS

Global Mobile Personal Communications Systems (“GMPCS”) are satellite-based telecommunications networks for voice and narrowband / broadband data. Initially some of the operators expected to capture a mass market for their technology, but by the time service was launched in the late 90’s, the mobile service explosion and coverage expansion had almost eliminated demand and caused very high profile corporate failures and bankruptcies (e.g. Iridium).

Most of the satellite operators today serve special niche markets such as companies operating in remote regions (mining, oil & gas exploration, construction, etc.), governments (e.g. military), NGOs (e.g. disaster relief), transportation, maritime and other special user groups. System operators for these market segments include ACeS (Asia), Inmarsat, ICO, Iridium (World-wide), Globalstar (world-wide excl. most of sub-Saharan Africa, the Indian subcontinent and South East Asia), and Thuraya (Europe, North and Central Africa, Middle East, CIS, and South Asia).



Whereas the 'go anywhere' concept is potentially attractive as a solution for remote rural communications, there are limitations related to the cost and practical interconnection of the satellite and terrestrial networks when considered for domestic rural applications.

GMPCS systems include both high earth orbit Geo-Synchronous (GEO) systems and low earth orbit (LEO) systems. In comparison with GEO systems, LEO systems have more satellites orbiting closer to the earth, thereby providing path diversity and relatively little latency (noticeable delay due to the long distance travelled by the signals to/from the satellite). LEOs also enable the use of smaller lighter user equipment, and dual band phones that can roam on terrestrial cellular networks.

Both GEO and LEO mobile satellite operators need a GMPCS Ground Segment. This usually comprises the Primary Gateway and the Regional/ National Gateways. For example Thuraya's Primary Gateway is situated in Sharjah, UAE, and is responsible for Thuraya's entire network, in addition to serving as the operator's main digital exchange. As of today, Thuraya has no Regional Gateway.

For a local or domestic long distance call, if there is no gateway in the country to terminate the call, the call is subject to international long distance costs. The lack of gateways is an important reason why even local calls can be quite expensive. In practice, this means that a call from, say a rural Moroccan village to Casablanca, would be via satellite to the Primary Gateway in the UAE, then into the PSTN of UAE and then interconnected to the Morocco PSTN, possibly again via satellite and/or a third operator. Since all the various operators involved will want interconnection fees and international settlement revenue, this call will be quite costly. Since it contains possibly two satellite hops, it will also be very poor quality.

This is the main constraint today of many GMPCS operators, they do not have the terrestrial gateways in place so they could serve rural areas in developing countries at feasible costs. Also, the satellite gateways of the ground segment are fairly expensive. If there are only few customers in a country, the investment would not be justified.

Inmarsat is the GMPCS operator with the largest number of terrestrial gateways or land earth stations (LES). Inmarsat has been a limited company since 1999, providing voice, fax and data services to 64kbit/s to more than 250,000 ship, vehicle, aircraft and portable terminals. The company has about 40 LESs located in 30 countries and is now more heavily marketing services for fixed rural applications.

Thuraya's geo-synchronous satellite has a footprint covering some 99 countries in Europe, Africa, Middle East and Asia. The satellite was launched October 21 2000 and services made available commercially in May 2001. Voice, fax, data, short messaging and other services including Internet access are available in some 40 countries to-date. However, as of yet Thuraya has no local terrestrial gateways outside the UAE.



6.5 Multi-access, Point to Multipoint (PMP) radio

Point to Multipoint radio is a distributed wireless network infrastructure ideally suited to connect numerous scattered settlements to the PSTN. The PMP solution is one of very few terrestrial alternatives for connecting villages in mountainous terrain. PMP is increasingly under threat from cellular and other wireless products, however the technology is mature and typically provides voice, data and Internet connectivity, and can also support other services (e.g. facsimile, packet switching). Unlike most wireless alternatives, PMP provides near-PSTN quality of service.

Due to the substantial cost involved in installing remote stations, particularly civil works, tower and power supply, subscriber density at each remote station should ideally be fairly high (e.g., dozens of subscribers or more). Average cost per line or subscriber in rural applications can be in the order of \$2,000-\$5,000, or more depending upon number and size of settlements and number of



telephones per settlement, terrain, and availability of power. The main strengths of PMP systems are: (i) ability to connect settlements over long distances from the PSTN; and (ii) cost-effectiveness in mountainous terrain.

Many countries world-wide have used PMP systems in their rural networks. Examples include Philippines, Thailand, Chile, Saudi Arabia, Kenya, Botswana and South Africa. PMP systems have a long range; using repeaters some systems can connect settlements hundreds of kilometres from the PSTN. The system utilises network central stations, each of which typically connects to remote sites located in villages. Subscriber equipment in villages is connected to the remote via a wire drop between the terminal and subscriber radio equipment located on the roof or on the side of a building. Some vendors can also provide wireless local loop sub-systems with a range up to 50kms, eliminating the need for drop wire at the customer premises.

6.6 Wireless Local Loop systems (WLL)

WLL, also known as fixed wireless, is a radio system used often by fixed line operators to roll-out voice and data services rapidly and efficiently in urban and peri-urban areas. WLL is useful where demand is uncertain, wire-based networks would be too expensive or time consuming to deploy, or rights of way and other authorisations difficult to obtain. Some countries have awarded WLL spectrum to operators to enable use of WLL technologies in competitive environments. WLL systems are also being used in rural areas where subscriber numbers and density per location are low and installing wire-based local loops is not cost effective.

Average cost per line or subscriber in rural applications can be in the order of \$1,000-\$1,500, or more depending upon population density, terrain, and availability of power. The need for repeaters and large towers to span long distances, or to provide coverage over or around hills, as well as need for dedicated power supplies including solar panels, are factors that can double or triple installed cost per subscriber for rural applications. Cost reduces substantially in relatively flat, high-density applications.

Typically, wire-based local loops cannot be extended more than 5km from the switch without attenuation degrading the signal. WLL systems can extend much farther, typically up to 35kms (similar to cellular systems), thereby saving substantially on wire line investment required in the “last mile”. WLL also eliminates much of the market risk associated with new implementations since, unlike wire-based local loops, WLL systems can be moved or enhanced according to the location and amount of market demand. The typical technology upgrade from WLL might include installation of a small rural switch then, if demand warrants, installation of local loops and displacement of the WLL equipment to a new unserved location.

The rise in popularity of WLL systems has led to the growth of many suppliers and wide-ranging availability of WLL in numerous frequency bands and for applications ranging from telephony up to broadband data and Internet. However, mobile cellular systems are sometimes more popular than WLL systems for telephony because cellular often has lower-cost expansion solutions and lower cost handsets, and offers mobility. In some countries though, WLL operators can offer limited mobility within a customer’s ‘home cell’ as competition to mobile.

Overall, WLL has not yet seen the amount of deployment that was initially expected. Therefore several WLL manufacturers went out of business and some larger telecom equipment manufacturers closed down their WLL departments (e.g. Nortel). As a consequence WLL equipment costs are still relatively high compared to cellular networks, as the lack of economies of scale has not resulted in expected cost reductions.

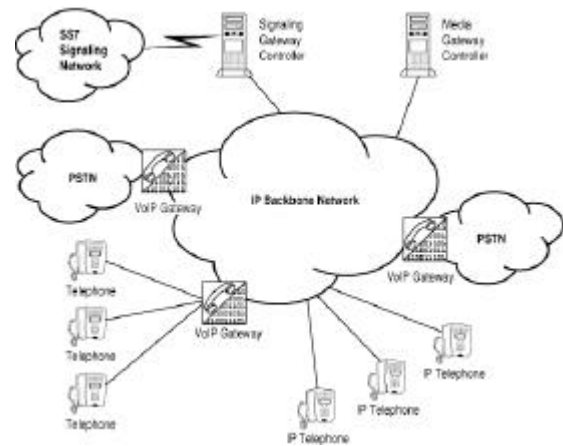
6.7 Voice over Internet Protocol (VoIP)

Unlike traditional voice circuit switching, Voice over Internet Protocol (VoIP) is a packet-switched service, and the packets can be sent ‘for free’ over the Internet. VoIP is relatively new but has spread very rapidly world-wide and continues to grow at a high rate. The proliferation of VoIP has accompanied the rapid increase in internet access – both private and public - during the 1990s,



coupled with availability of software that enables a computer equipped with a speaker and microphone to be used as a telephone. The key advantage of VoIP for the consumer is that it offers low-cost telephony services, because it bypasses traditional traffic routing and the accompanying charges from the network operators. Therefore, currently many Internet café's and telecentres use VoIP to provide low-cost telephone service.

More recently, VoIP has become a 'main stream' service of some of the largest telecommunications companies in the world for backhaul of domestic and international transmission of voice telephony. However, one area of uncertainty is regulatory treatment of VoIP. Countries are experiencing an increase in VoIP origination by service providers who are licensed to provide data services, and monopoly incumbent operators are losing revenues. There is some risk that regulators acting to protect the incumbent telephone companies will ban provision of VoIP services, and cost-savings of this technology and the overall benefit to the economy as a whole cannot be realised. Panama recently announced a ban on VoIP and Turkey announced a ban on third party VoIP service providers.



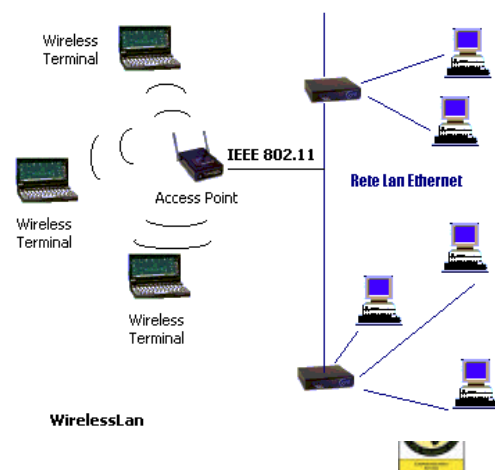
VoIP service providers – both retail and wholesale - are numerous; more well-known ones include Net2Phone, iBasis, Primus, ITXC, and others. Some of the world's largest telecommunications companies have announced wide-scale implementation plans for packet voice, or plans to switch completely from traditional circuit switched telephony to packet voice using their own networks or those of a wholesale service provider. Examples include Cable & Wireless, Telecom Italia, Telus (Canada), Telstra (Australia) and Sprint in the US. Indeed, in the near future voice networks will exist that are entirely IP-based. South Africa is experimenting by allowing VoIP for rural operators in low density areas.

Currently, main technical concerns with VoIP have to do with voice quality and inter-operability between different vendor equipment. Current IP version 4.0 has the ability to prioritise voice over data packets but this feature was never widely implemented for various reasons, one being that each vendor has implemented the feature differently hence international inter-working has limited end-to-end quality of service (QoS). Current services that use the public Internet as their transmission network (as opposed to a virtual private network or leased lines) are sometimes affected by noise and dropped packets. IP version 6.0, which is only now slowly being implemented, is expected to provide, among many other improvements, easier prioritisation of voice over data packets and provide better QoS enabling, leading to better service level agreements. Recognising the current limitations in which a number of vendors that specialise in VoIP equipment use proprietary systems that do not allow easy inter-operability with network elements sourced from other vendors, investigation is necessary before deciding upon VoIP equipment for new network implementations. Overall, however, VoIP is working relatively well and will continue to proliferate all over the world.

6.8 Other emerging wireless solutions & applications

Wireless Local Area Networks (WLANs)/ Wi-Fi

Wireless Local Area Networks (WLANs) are relatively new, but are proliferating in the US and elsewhere. Current standards include IEEE 802.11a and 802.11b, the latter of which is known as Wi-Fi™ and operates in



the 2.4 and 5GHz bands. WLANs provide high capacity wireless connections between office equipment and components such as computers, printers, scanners, etc. The most popular installations for WLANs in higher-income countries are busy public places like airports, hotels, conference centres, shopping malls and coffee shop chain stores. WLAN nodes are also in offices and are also increasingly common in private homes. Operators of WLANs and mobile cellular companies alike are taking a keen interest in WLANs. For example, T-Mobile, the German cellular telephone company, has some 1,400 WLANs in coffee shops in the US at a cost of around \$7,000 per installation. Given the very high data rates, WLANs will compete to some extent with Third Generation mobile telephony. For example the Bahrain telecommunications company Batelco has announced it will not implement a 3G mobile network, but instead use WLANs as a 3G replacement, on the grounds that mobile broadband is not needed in Bahrain and broadband fixed wireless networks such as WLANs are better suited to the local market.

Data speed of 802.11b WLANs ranges from 9-12Mb/s, but faster WLANs are being developed as well including 802.11a (54 Mb/s at 5 GHz) and 802.11g (22 Mb/s at 2.4 GHz). WLANs can be used indoors or out however in comparison with a WLL system their range is very limited to about 100 meters indoors and 300 meters or less outdoors. The application to rural areas would be limited to institutional compounds and public access systems, though 'Bluetooth' (see below) is perhaps more applicable.

Ad hoc peer-to-peer wireless routing systems

As a development of the above type of system and more interesting to rural areas are ad-hoc peer-to-peer wireless routing systems. These provide relatively low cost broadband wireless access over a wide area, in a non-centralised fashion. Various radio frequencies are being utilised by these systems, e.g. from mobile bands up to 3.4GHz. By combining wireless access with distributed intelligence and decision-making, acting as routers, these networks enable mesh-like or 'daisy-chain' extension of Internet access to a flexible number of user points. The main requirement is that every new site be able to 'see' at least one other site in the network in order to bring it into the system. Several suppliers are developing these products and the number is likely to increase rapidly. Whereas initial deployments have been in industrial and business applications, apparently ranging from mobile to 3.4 Ghz fixed applications, the potential is much broader once this frontier technology becomes field proven, even though bandwidth capacity apportionment issues have to be dealt with.

The advantage of these systems is that new terminal locations can be added in a flexible manner and do not have to have line-of-sight to a central location. The transmission range varies with each product, and may allow new sites to be added as far away as, say, 15km or more so long as they have line of sight to at least one other site. Regardless of the radio technology used in the network, all nodes recognise and communicate with each other directly or indirectly and share common bandwidth.

The systems typically support industry standard IP applications and computers transparently, without requiring any modifications or additional interface equipment.

The application of these systems is their ability to provide institutions and business users with access to an Internet POP, say at a district centre, within the general vicinity of the POP but perhaps over a range of many kilometres.

Bluetooth

Bluetooth is a short range, low power wireless system that is intended to replace cabling between devices. It enables links between mobile computers, mobile phones, portable handheld devices, appliances, and connectivity to the Internet. A collection of devices connected in an ad hoc manner via Bluetooth is known as a Piconet. A Piconet may have up to eight active devices with one device acting as master and the others acting as slaves for the duration of a Piconet session.



Devices that are compatible with Bluetooth operate in the 2.4 GHz band and require no spectrum license. Bluetooth is to some extent a competitor to wireless WLANs and a complementary technology to cell phones. The most popular uses of Bluetooth are expected to be connectivity between a PC and the Internet via a cell phone for email and data, and connectivity between a hands-free kit and a cell phone for voice communications.

Some piloting is being done of Bluetooth for low-cost rural applications, such as specially designed “village personal digital assistants” (village PDAs). The PDAs are used as hand-held information access tools that use Bluetooth to connect to info-kiosks, or small low-cost telecentres with network access provided by cellular or VSAT networks.

Any device compliant with the Bluetooth standard will operate with any other Bluetooth-enabled device. Bluetooth provides secure, encrypted links. The current Bluetooth range is less than 10 metres in the 2.4Ghz band and data rates range from 384kbps to 1Mb/s. Higher data rates are expected in future.

6.9 Power issues

Powering telecommunications infrastructure and end-user equipment as well as other ICT applications is a challenge in rural and remote areas. The overwhelming majority of rural areas lacking telecommunications also lack electricity supply. Providing ICT to rural areas thus needs to consider how to provide the electricity to power ICT as well. The following gives a brief overview of some of the options. An in-depth description of power issues can be found in the ITU report *New Technologies for rural applications*, in section 5 on Renewable and off-grid energy solutions.

Power requirements can be divided between telecommunications infrastructure power requirements and end-user terminal power requirements. Operators are using renewable power sources and hybrid systems (using both renewable and fossil-fuelled energy generation) mostly for repeaters and base stations. However, this usually increases the capex and opex substantially. It is difficult to give a rule of thumb figure for power costs as they have a fairly large local component, which could vary widely. Overall, site or support facilities (incl. shelter, tower, power, security, etc.) can be more than double the radio equipment costs.

Power is a very crucial component and often not done very well. It is for example often the number one contributor to poor reliability of radio systems. Even in rural areas that have power there are issues such as how to back it up, especially if there are many power outages, and decisions here depend on how much service (i.e. revenue) is at risk. Batteries are a cheap back-up depending on how big the outage statistics are. Generator sets are not cheap, in particular operating costs and often fuel is paid in foreign exchange. A good metric to express power costs is in \$ per watt for capital and % of capital cost for operating.

Common electricity sources or solutions for end-users in rural areas are kerosene for lighting needs, dry cell batteries and fuel-powered generators. The latter are fraught with drawbacks, from supply constraints, costs, operational issues to environmental pollution.

Other options are renewable power technology, such as solar power, wind energy, micro-hydro power and clockwork power.

- *Solar power or photovoltaics (PV)* is in general most cost-efficient when only modest levels of electricity, up to a few hundred watts, are required. Manufacturers are also now offering portable solar-powered charging systems, e.g. for laptops or cellular phones for as low as US\$ 100-200. Small pre-assembled systems, reducing complexity of installation, providing 100-200 watt hours per day cost less than US\$ 1,000. Solar costs go up with latitude because shorter days require bigger panels and longer nights require bigger batteries.
- *Wind energy* installations require careful location selection and placement. An annual average of 6.3 meters per second wind speed is required for 300 kWh. Whereas wind power systems require a higher initial investment, they have a long lifetime and cost less than solar power. However, they are more limited in their placement, including being less attractive in areas with



frequent lightning storms. Wind turbines are less complex for maintenance and trouble-shooting.

- *Micro-hydro power* usually produce less than 100 kilowatts, and its appropriateness and cost-efficiency depends on the available water resource, i.e. a river and the consistency of its water levels. Micro-hydro power systems cost less than both solar and wind systems, and are also simple to maintain but need more regular attention.
- *Clockwork power* has been invented in the last decade. Clockwork-based induction motors are wound up manually with an external crank handle, and can be used to power small devices such as radios and flashlights. It is very cheap, e.g. less than US\$ 100. Whereas experiments have shown that this technology can be used for powering laptop computers and cell phones, it has not been developed yet as a commercial offering.

One power system cost that can be sometimes forgotten is surge protection. This could range from the careful installation of ground wires for radio sites to simple protection devices for computer and telephone end-user equipment in telecentres.

Power and telecentres is also a problematic issue. Power requirements of a larger number of PCs are quite high, thus powering a large telecentre off-grid is often not feasible. This adds another reason to the emerging understanding that telecentres should start small.

6.10 Low cost end-user terminals & delivery devices

Rural telecentres and programmes in education, e-commerce and telemedicine use the capabilities of ICT devices to enable a range of functions including data entry, information retrieval, voice communications and messaging services. Personal computers (PCs) are frequently used to support these services, but can be difficult to operate and maintain in rural areas. Therefore, it is helpful to review a range of low cost ICT devices and applications that could be valuable for rural users.

Thin Client systems (network computers)

Thin client systems (also known as “network computers”) are specialised client/server systems in which most of the processing is done on the server. The terminal has no independent intelligence but can access standard computer applications. Thin client systems could be suitable for use in rural telecentres, schools, etc. as part of a local area network. However, thin client systems are not suitable to provide rural users in developing countries with affordable, networked computing over wider areas because considerable bandwidth is required between the thin client and the server.

The relevance of thin client systems has diminished considerably in the last two years. Recent declines in computer prices have eliminated the cost advantages of thin client systems over standard PCs. For instance, Compaq’s lowest priced thin client system, the Evo T20, now sells for \$399 US. An inexpensive PC running Linux, such as the Microtel Sysmar710 sells for \$199 US without a monitor (inexpensive new monitors cost less than \$100 US). The same system using Microsoft Windows XP costs \$299 US. For more information on thin client terminal and PC pricing, <http://computers.cnet.com/> is a useful source.

Linux

The Linux operating system has the potential to reduce the cost of computers. Linux is an open-source operating system for use on PCs and servers. Linux is therefore available free for downloading and copying. Though there are not as many software applications available for Linux as there are for Microsoft’s Windows, there are a number of low cost applications available, such as Sun’s Star Office package (includes word processor, spreadsheet, presentation, drawing and database). Obtaining service and support will likely be more difficult for Linux than for Windows. Fortunately, the popularity of Linux is increasing rapidly and it is not considered difficult to learn. Using the Linux Terminal Server Project system could further reduce computer costs in rural schools or telecentres. Trials have been taken place in South Africa for example. The system



requires only one server with a hard disk. Other PCs can be networked to run off the server's hard drive and thus even computers without a functioning hard drive can be re-used. To find out more, <http://www.linux.org/> offers extensive information and operating system downloads.

Refurbished computers

The use of refurbished computers is another way of reducing technology costs for rural users. Organisations such as World Computer Exchange (WCE) can provide inexpensive used, working, Internet-accessible computers. Though used computers might not necessarily be capable of performing all of the functions of a new computer, they are adequate for many users who only require e-mail and word processing functions. The cost of refurbished computers varies depending on the source and the type of computer, but usable refurbished computers can be purchased for under \$100 US. See <http://www.worldcomputerexchange.org/> for more information.

Hand-held computers

If the full functionality of a computer is not required, there are numerous hand-held devices that could be practical for rural users. Hand-helds, typically referred to as personal digital assistants (PDAs), come with a wide range of capabilities and prices. PDAs can be easier to use than PCs, yet still offer useful applications. Some PDAs have even been developed expressly to help bridge the digital divide.

For instance, MediaSolv has developed the VillagePDA, which is supposed to cost less than \$50 US per device when and if it becomes commercially available. Applications for the VillagePDA include e-mail, address book, calendar and instant/short messaging. The device operates over a wireless network connected by Bluetooth. In this way, up to seven devices can share a single Internet connection. A trial of the VillagePDA is taking place in Kenya in conjunction with Environmental Liaison Centre International (ELCI). Information about the VillagePDA can be found at <http://www.villagepda.com/>.

The Simputer, a hand-held device developed in India and manufactured by Encore Software and BEL-PicoPeta, is expected to sell for as little as \$200 US. The device is designed to be shared by a local community of users such as a village, a school or a retail kiosk. The device can inter-work with PCs and peripherals such as printers and can connect to the Internet through a V.34/V.90 modem. A touch-sensitive screen is the Simputer's primary input device. For more information on the Simputer, please see <http://www.simputer.org>.

While the VillagePDA and the Simputer have been delayed for numerous reasons, other manufacturers have released new, lower-priced PDAs. For instance, computer maker Dell produces the Axim X5, which sells for \$249 US, has a colour touch-screen and uses the Microsoft Pocket PC 2002 operating system. The Axim can be connected to a network via either Bluetooth or Wi-Fi 802.11b.

The key to all end-user equipment as well as for telecommunications and Internet infrastructure equipment for rural ICT projects are the following three concepts: upgrade-ability, scalability, and replicability, allowing the project and underlying infrastructure and technology to grow with increasing demand and evolving user preferences. These concepts also allow a project to start small and thus maintain sustainability and commercial viability.



7 SOCIO-ECONOMIC IMPACT

Overview: This section provides guidelines on a methodology for considering a project's socio-economic or developmental impact, namely:

- Does the project support developmental principles, which are in line with the current 'best practice of policymakers, development and funding agencies, and how?
- Who are the project's beneficiaries?
- How will they be impacted, and what will be the distribution of benefits from the project between various people groups or communities?
- Can the benefits be quantified in any way?
- Sustainability - How do the benefits from the project relate to the ability or willingness of the target communities to pay for the project's outputs, or the willingness of project sponsors (e.g. government or institution) to underwrite costs in the long run?

The guidelines assist with developing the project's socio-economic rationale but should be used carefully and appropriately to the situation, as explained in the following sections, since not every project will lend itself to a full analysis.

7.1 Qualitative or quantitative?

Socio-economic impact analysis can be qualitative or quantitative, or (as in many cases) a combination of both, where indicative estimates of potential or expected impacts are provided to support what is essentially a qualitative argument.

The analysis should be built up from the general to the specific, but the logic of the analysis must extend from the market (financial and commercial) to the socio-economic, i.e. from perspectives focusing on user needs and demand to developmental rationale and impact. Projects that have these two aspects in balance are the most likely to succeed. On the other hand, projects that skip the market side and seek justification based solely on socio-economic and developmental cases are the most likely to have severe sustainability problems.

7.2 Qualitative analysis

The basic issues to be addressed qualitatively are summarised by the following tables:

- **Table A** (next page) provides a checklist to define the project's core ideas, values and approach in a qualitative manner. This covers the overall developmental rationale and justification.
- **Table B** builds a more market-oriented view of the project's deliverables, their viability, and the hurdles that may be faced either at implementation or with long term sustainability.



Table A – Developmental rationale	
Vision and objective	<ul style="list-style-type: none"> What is the project's core idea, specific objectives and key outputs? Describe the before/after picture (E.g. 250 villages, which previously had no access to the telephone will now have public phone shops and available private services; 25 institutions serving rural communities and addressing specific social issues will have high speed access to the Internet through five new regional Internet POPs.)
General development focus	<ul style="list-style-type: none"> Is the project consistent with development goals that have been identified by policymakers or other development actors in the country or countries where the project will take place? Does the project have the potential to influence larger development agendas, within the telecom or ICT sector (e.g. market liberalisation) or further afield (e.g. break new grounds in education or health)? Will the execution and success of the project promote sustainable and equitable development?
Project beneficiaries	<ul style="list-style-type: none"> Is the project targeted on any specific communities, classes of people, income groups, age groups, gender? How will the project address the needs and demands of its target groups?
Nature of the benefits	<ul style="list-style-type: none"> What is the primary nature of the benefits of the project? E.g. access to voice communications, business information, health information, education, government services. Will the project have any impact on employment, working conditions or quality of life? What secondary impacts will the project have – e.g. better delivery of social infrastructure services (e.g. education, health & welfare)? What will be the effect on culture, values, freedom, democracy, etc.?
Distribution of benefits	<ul style="list-style-type: none"> What specific benefits or opportunities will various income classes, especially the poor, enjoy? Will the project help to empower the poor, vulnerable or disadvantaged groups, and how? What will be the degree and nature of local participation in the project design, implementation and ownership?
Gender considerations	<ul style="list-style-type: none"> Does the design and methodology of the project take into account different gender roles, perspectives, interests, and priorities? Is the project's potential impact assessed from a perspective that recognises gender inequalities and imbalances? Will research data, demand and expected impacts be broken down by gender? Do the project's capacity-building features reflect gender considerations? What are the specific value of the services to women, e.g. in facilitating better access to information, assistance, credit and business opportunities? These should be cited as specifically as possible. What is the value and usefulness of the services provided? These should be explained in detail, and the targeted outcomes described.



Table B – Market, prices, project sustainability and regulation	
1. User need & Demand	<ul style="list-style-type: none"> Has the development rationale for the project been confirmed through a baseline study demonstrating people's interests, needs, demand and preferences for the project services? Does/will the analysis identify the various user groups identified in the project objectives?
2. Services & prices	<ul style="list-style-type: none"> How will the project outputs be paid for, and how do the prices charged relate to the cost of supply? If there is a difference between cost and price? If so, why is this, and why cannot cost-based prices be charged? Is the problem related to affordability or regulation, or both?
3. Affordability & willingness to pay	<ul style="list-style-type: none"> Does the requisite baseline study address affordability and willingness to pay? What are peoples' opportunity costs to satisfy their communication or information needs, without the project? Have they already demonstrated a willingness to incur these costs (e.g. by travelling), or is the idea of communicating and securing information relatively new? In the case of Government or institutions as users of ICT, what is their willingness or ability to pay for the ICT services, and what are the opportunity costs to provide the end services they are responsible for without the project?
4. Costs	<ul style="list-style-type: none"> Does the project deliver the proposed services in the most cost-effective way possible? E.g. Has the most cost-effective technology been considered/ selected?
5. Policy & Regulation	<ul style="list-style-type: none"> Are the prices/ tariffs to be charged regulated by government? What flexibility exists? Are there any regulatory impediments that constrain the project from delivering the services in the most cost-effective manner? (E.g. technology choice or licensing, enforcement of interconnection with incumbent operator, etc.)

7.3 Quantitative analysis

A quantitative socio-economic analysis requires the analyst to:

- ▶ Carry out a normal cash flow analysis using capital and operating costs and revenues to calculate a net present value (NPV) or financial internal rate of return (IRR) in the normal way
- ▶ Adjust the revenue flows to 'economic values' by:
 - estimating the economic benefits received by recipients of the project's output/ services over and above the price they pay for the services
 - using this information to derive an 'economic valuation factor (EVF)', and
 - using the EVF as a multiplier to convert the project's financial revenue streams into economic benefit streams
- ▶ Adjust the costs using 'shadow prices' which reflect the economic value of the various cost items, such as skilled and unskilled labour, imported technology, etc., and eliminate taxes (which are not a cost to the economy)
- ▶ Recalculate the project's NPV or IRR using the adjusted economic values to calculate the economic performance – e.g. an economic internal rate of return (EIRR).



For the purpose of simplification, the methodology provided in this Toolkit will not deal with shadow pricing of costs (which are often a somewhat academic exercise), but does explain the methodology for calculating EVFs and for re-calculating the revenue flows, which has a more significant impact. The methodology was first developed for the Asian Development Bank for the economic analysis of telecommunications projects and is fully applicable to the African setting. A full description of the complete methodology can be found in the publication²¹.

A basic Excel spreadsheet showing the financial evaluation of a sample rural ICT project, and demonstrating the incorporation of EVFs in the analysis is provided in Annex B.

What are the socio-economic impacts?

In the case of telecommunications projects at least, it can often be demonstrated that there is significant benefit in the form of 'consumer surpluses', over and above the price paid for the service. These include items such as the following:

- Businesses (small or large) often report that the money they save in greater efficiency and saved personal travel time related to stock control, delivery co-ordination, following up sales opportunities, maintenance calls, etc. amount to several times the cost of the telephone rental and calls they make.
- Farmers and micro-business proprietors often report that the phone enables them to gain timely and geographically specific knowledge of urban market prices that increase their bargaining power with 'middlemen' and enable them to earn more for their product or secure a better price for their inputs.
- Individuals – farmers, micro-business women, students - living in rural areas typically report that at least one third of their calls (e.g. from a public or shared phone) concern business matters that would have required them to travel to deliver a message, secure an answer, respond to a problem, etc. The amount of time and travel costs they save may amount to several times the cost of the call – the more remote the community, the higher this 'opportunity cost' saving.
- A further one third of calls also typically represent personal or family emergencies that would again require travel or other costs if the call was not made. Sometimes people report their benefit in terms of lower health risk, a life saved, better family relationships, more opportunities.
- Institutions and government agencies – schools, clinics, council offices, NGOs and other development agencies - similarly report increased efficiencies and the ability to deliver services in a more timely, effective and less wasteful manner through use of the telephone.
- Students and others can learn to use computers, download teaching materials or business information and sign up for courses, securing major benefits and future career or business opportunities from so doing.

The challenge is to research and secure this data in an organised, rigorous and balanced way, which sensibly estimates the potential benefits as a percentage of the total usage of the services. For example, it could be that only a small minority of calls or system usage is providing these benefits, or it could be that 50% or more of the usage has these impacts. It is thus important to clarify this, if known, and to 'weight' these according to the percentage of total calls they represent, so as not to over-estimate or under-estimate their potential impact on the whole.

Non-voice ICT services: Applications such as gaining information from the Internet through email or other text messaging services will also increasingly offer similar benefits as the Internet diffuses towards rural areas. However, for now the demonstrable benefits are *much* less. Even if a case can be built that economic benefits result from Internet sources, it is often questionable whether the same benefits could not be gained from a simple phone call or through a voice messaging service. It is important to be realistic in the assessment.

²¹ "Guidelines for the Economic Analysis of Telecommunications Projects", EDB Economics & Development Resources Centre, 1997



Table C provides a sequential methodology for estimating benefits quantitatively, *if the project lends itself to such an analysis*. Only the questions relevant to the case under consideration need be answered. Thus the analyst can 'pick and choose' to suit the case. However, the more comprehensive the methodology used, the more understanding of the project's impacts can be gained.

Table C – Economic valuations – sequential approach	
1. Identify the specific user groups	<ul style="list-style-type: none"> • Arrange into categories, e.g. 20% male farmers, 10% female heads of household, 20% schoolteachers, 20% government workers, 20% students, 10% micro-enterprise women. • Refine the categories to reflect groups which can be identified economically, as discussed below
2. Estimate the realistic monetary or economic benefits enjoyed from the project by specific private user groups (include individuals, micro-enterprises and small businesses).	<ul style="list-style-type: none"> • E.g. if making a call from a public phone, securing information from a telecentre, or undertaking an tele-educational course reduces lost time or out-of-pocket expense due to less travel, list these as case examples. • For the most identifiable cases, estimate the size of benefit received (the \$ saved compared to the alternative way of communicating– i.e. the "opportunity cost") compared to the price paid for the telecom or ICT service. • Estimate how "typical" these cases are – i.e. do they represent the majority of users, the average user, or a small minority? • Prepare a profile of case types, matching user categories if possible. • Estimate some typical 'benefit-to-cost' ratios (i.e. benefit received versus price paid for the telecom or ICT service)
3. Make estimates of benefits received from small and medium sized businesses	<ul style="list-style-type: none"> • E.g. a business owner might say "I pay \$50 per month for this service, but my benefits are five times this amount in saved time, more efficient inventory control, and sales that I would not be able to make without the service." • Estimate how typical this story is amongst users of the service, and estimate a typical range. • Estimate typical benefit-to-cost ratios. • Estimate how much the business owners would be willing to pay for the service if the price were increased. (This might be an indication of how real the benefits really are.)
4. Estimate the realistic monetary or economic benefits enjoyed by institutional or government users	<ul style="list-style-type: none"> • What programs are enhanced, enabled or improved as a result of the telecom or ICT service? • Who are the beneficiaries of the organisation's program(s)? • What are the savings in terms of time, transportation cost, staff efficiency as a result of the ICT service? • Estimate typical benefit-to-cost ratios. • If the organisation does not have to fully pay for the service, estimate through interview with management what it might be willing to pay.
5. Identify locality specific factors	<ul style="list-style-type: none"> • Determine if the benefit to cost ratios estimates in 2, 3 & 4 above vary depending on locality size and type, distance from the main population centre, etc. (see Table D for illustrative purposes). • Identify benefit-to-cost benchmark categories for a limited number of locality types if possible
6. Place an "economic value" on the revenue stream of the project	<ul style="list-style-type: none"> • From the estimated benefits or benefit-to-cost ratios received by the users of the telephone or other ICT services, as estimated in steps 1-5 above, calculate a composite economic valuation of the revenue stream, as illustrated in Table E.
7. Identify other benefits or externalities from the project	<ul style="list-style-type: none"> • E.g. in telecom projects, incoming call revenues in the form of interconnection payments must be added as benefits, but should really be added to the financial (business case) analysis. • Add an estimate of benefits received by non-users, who will be the recipients of services enhanced by the institutional ICT users. (This can typically only be described qualitatively.)



Benefit to cost ratios and EVFs

Table D provides a hypothetical set of benefit-to-cost ratios indicating an order of magnitude for benefits, compared to the price paid for telephone calls by various categories of user from various types of locality. In the event that a project sponsor wishes to estimate the composite benefit-to-cost ratio and to re-value the revenue stream of a rural telecommunications project, a table such as this could be constructed to represent the users and call traffic on the network and justify the economic valuation estimates.

Table D – Benefit-to-cost ratios for telephone calling from various localities					
	A District centre	B Large trading centre	C Smaller trading centre	D Village close to trading centre	E Remote village, only 1-2 phones
Government/administration	1.2	1.3	1.5	1.7	n/a
Institutions & NGO	1.7	2.0	2.0	2.5	3.0
Micro-business	1.2	1.5	1.7	2.0	2.5
Trader/ agricultural business	1.5	2.0	2.5	n/a	n/a
Residential calls	1.1	1.1	1.1	1.1	n/a
Public phone (sole phone)	n/a	n/a	2.0	2.5	3.0
Public phone (others exist)	1.3	1.5	1.7	n/a	n/a

Annex A provides a detailed explanation of EVFs and how to calculate them. If budget is available, the estimation or verification of figures can be undertaken through a formal demand and benefits survey. See Chapter 6. But it must be emphasised that EVF estimates are approximate at best.

A re-calculation of the project's IRR would need to estimate the weighted average benefit-to-cost ratio or EVF for the whole revenue stream. Table E provides a sample calculation for a composite EVF.

Table E – Weighted average EVF		
	% Traffic	EVF
Government/administration	10%	1.2
Institutions & NGO	10%	2.0
Micro-business	10%	1.8
Trader	20%	2.0
Personal business or urgent	20%	1.7
Personal, non business or urgent	30%	1.1
Total weighted average	100%	1.57

Experience has shown that the weighted average benefit-to-cost (i.e. economic value to financial revenues), after the proportion of personal, business and official calls on a network have been considered, can be typically between 1.3 and 1.7. This means that the economic benefits – or consumer surplus - derived from a telecommunications project, over and above the revenues paid for the service by the users, can represent up to 70% of the project's revenue stream. If the project is exclusively rural and provides communications to remote communities, the additional benefit could exceed 100% of the revenues. This means that the project's economic internal rate of return (EIRR) is considerably higher than the purely financial IRR.



As already discussed, this is most applicable to voice telephone projects. The benefits from non-voice ICT services are usually described more qualitatively, with anecdotal or indicative “stories” of the potential benefits derived by some users.

7.4 Application of the impact analysis to funding & project design

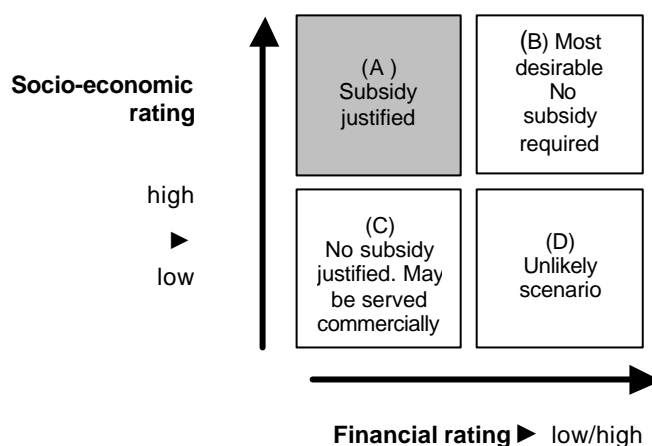
The purpose of the socio-economic impact analysis is to understand, formulate and document the justification for financial support and to allow economic impact considerations to shape and influence project design to maximise the chances of ‘smart subsidisation’, i.e. intervention which leads to self-sustaining and commercially viable operation. This is developed further in Chapter 9.

Telephony

It has been noted that rural telephony projects have a clearly defined socio-economic impact, stemming from the quantifiable nature of the benefits in terms of users being able to eliminate alternate costs when making and paying for a telephone call. Strategists have also been able to use the insights of economic impact analysis to contribute to the design of rural telephone services. In particular, the ‘universal access’ package consisting of services to rural institutions, businesses and public village telephones, when provided in a market-responsive way by motivated operators, can carry very significant economic benefit.

However, geographical areas can be categorised comparatively in both financial and socio-economic terms to highlight which ones justify subsidy, and approximately how much. As illustrated below, areas with low or marginal financial return but good socio-economic returns, can be identified as justifying subsidy.

Category (A) – low or marginal financial viability in the short run, but high socio-economic impact, are the ones that justify subsidy the most. Projects with high impact will eventually generate good revenues since people understand the value of the services and will be willing to pay.



The financial support should be structured to assist mainly with start-up and market entry, while the telecommunications regulator should ensure that the tariff and interconnection regimes are designed to allow the operator to recover costs and make a profit. It will be seen that cases B, C and D most likely do not justify subsidy.

- *Category B* will offer good financial returns (acceptable NPV and IRR) and thus attract investors without subsidy (e.g. from mobile operators who will expand to serve the areas).
- *Category C* may have low socio-economic justification and low financial benefit. These very small and remote areas may be chronically unsustainable but justified politically and socially, and also require additional regulatory and fiscal measures (e.g. special cross-border licensing, interconnection and tariffs, and/or tax benefits) as well as external financial support.
- *Category D* is an unlikely scenario – very few localities provide less socio-economic return than financial return because of the benefit pattern described previously.



Non-voice ICT services

As noted in Chapter 6, the demand for non-voice ICT services in rural areas is not yet strong. Neither is it straightforward to demonstrate socio-economic impact, though the impact analysis must be used to probe and develop increasing knowledge of the role of ICTs in economic development.

We have seen that ICT demand comes mostly from ‘intermediate’ agencies & institutions that have activities and developmental roles in rural areas. In addition, the aggregation of ICT usage and demand at these points (e.g. through the sponsorship of public access centres), can gradually develop sustainable and potentially scalable ICT usage patterns.

The creation of ‘smart partnerships’ able to develop this growth cycle through relationships between education, other institutions, governments, business associations and leading small-micro-medium enterprises (SSMEs) is obviously an important factor in the development of the ICT market. This can and should be informed by considerations of socio-economic impact (and a monitoring process to track results – see Chapter 10) being designed into each project.

7.5 Short form of Benefits and Socio-economic impacts

Even if a project sponsor does not require a comprehensive socio-economic analysis, it is recommended that the following limited checklist of conditions always be considered in the approval process for any project. This provides essentially a shortened version of Tables A and B of the qualitative analysis in Section 6.2.

Project objectives and beneficiaries	Identify communities, social and income groups and outline how the project will address their needs and demand.
General impact evaluation	<p>For telecommunications (e.g. voice telephony) projects, the impact of having access to the telephone may be described generally in terms of cost-benefit due to the time or opportunity cost savings. E.g. at least some representative ‘with’ and ‘without’ scenarios may be used to demonstrate benefits to users of the telephone.</p> <p>For other ICT projects, e.g. a school Internet access, information call-centre or public telecentre, the impacts will usually be described more qualitatively, while any willingness-to-pay evidence of the economic value of the services should also be quoted.</p>
Gender considerations	<p>The specific value of the services to women, e.g. in facilitating better access to information, assistance, credit and business opportunities should be cited as specifically as possible.</p> <p>The value and usefulness of the services provided should be explained in detail, and the targeted outcomes described, with cross-reference</p>
Prices and regulation	<p>Relating user needs and demand to the price of the services and the role of the regulator, the market and actual supply costs in setting prices should be addressed.</p> <p>Issues such as deregulation, role of the incumbent operator, interconnection practices and general incentives for project sponsors and service providers to be viable, to meet user needs and demand and thus to sustain benefits for the economy should be covered.</p>



8 BUSINESS PLAN ESSENTIALS

Overview: Business plans are important to any ICT venture. For the donor or UA Fund supported projects, a business plan that meets certain minimum criteria and demonstrates sustainability of the project concept, as well as its development impact or 'outputs' will be essential to the application process, especially if the Fund disbursement does not involve a competitive tender. This chapter provides a checklist of subjects to be covered in an ICT project business plan

8.1 General market and financial requirements

A business plan should always have the following 'commercial' elements, which describe the project's rationale, demand basis, costs, expected revenues and financial performance. Other requirements dealing with project impact and development outputs have also been discussed in the previous Chapter and may also be required. However, there is no escaping the need for all project proponents to prepare a sound business plan. In the case of a competitive bid for the auctioning of subsidies, e.g. in a UA Fund telephone license auction, the preparation of a sound business plan is assumed, but should still be reviewed as part of the "due diligence" process to ensure bonafide submissions. The example given here assumes the case of a public access project - e.g. a phone shop, a telecentre, or a network of such facilities - being proposed to a fund or donor on the basis of a business plan, where an assessment of business plans is part of the selection process.

- **The project purpose and mission statement** – Brief introduction to the project idea, the need / opportunity and how the project addresses the opportunity.
- **Sponsorship & ownership** - A clear outline of the ownership structure and participants in the project, and whether the project will be a franchised or independent business, a community co-operative, an arm of local government, etc. Preferably it should be, from the outset, a commercial entity, even if parts are known to need contribution or subsidisation.
- **Market and beneficiary assessment** - A demand assessment (based on demographics, interests, economics, needs and affordability). The assessment should include a market description or study that assesses the role of the project compared to the availability of other similar services. The presence of other suppliers in the location (e.g. for a public access project, identify other PCOs/ phone shops/ telecentres, schools, hospitals), and the specific needs of the region, including the kind of information or services needed by the local community. Explain how they will benefit and how/why they will justify paying for the services. This should include an estimate of the expected number of calls, network 'accesses', minutes of use, messages, pages printed, photocopies, forms delivered, or whatever mode of information and service is to be offered.
- **Legal and regulatory framework, licences and authorisations** – Summary of the status of the project proposal with respect to licenses and authorisations. Does the project, or the site owner(s) require a license or special authorisation to proceed and have these been granted. If special authorisation is required, describe the steps taken and the likely outcome, the conditions attached and/or the outstanding issues to be resolved.
- **Marketing and sales plan** – Explanation of how the market potential will be realised, people sensitised and made aware of the service(s) and, if appropriate, drawn to the site(s).
- **Competition** – An assessment of how the market and sales assumptions could be affected by other similar installations, networks or alternatives, and the impacts on the project target.
- **Technical assessment** - An assessment of the area's access to telecom infrastructure, the topography, the access technology and other systems (e.g. power) required. This assessment



should suggest the technology that best fits the characteristics of the site(s), and the initial and ongoing costs to connect and maintain the facility or facilities.

- **Financial worksheet** - This should contain start-up expenses and start-up costs, as well as projections of number of users, traffic usage, prices and revenues, expenses, financing costs, operational costs and salaries, etc. Financial schedules, showing breakdown of costs and revenues for each major item, unit, department or service (e.g., telephone, fax, computer & email, training, photocopying, etc.) should be included. *Amortisation of costs, depreciation and replacement* strategy should be shown.
- **Financial 'bottom line' analysis** - This must show the profitability calculation and /or any variations from profitability explained, justified and projected into the future to show how the situation will improve.
- **Funding requirements** - Summary of funding requirements and of financial contributions, including in-kind contributions, from all sources. The scale of the investment and the scope of services proposed must be justified.
- **Operational plan** - Organisational chart, staffing plan, equipment and facility plans and assessment of possible problems and solutions.
- **Training, capacity building and any other human resource development** – The needs of the project and the assigned effort, plan, costs and partnership(s) to meet all stated goals for staff or users.
- **Community inputs** - If appropriate, an assessment of support from the local community (to confirm that the requirements are understood by the community and the sponsor(s)).
- **Partnership(s)** – After assessing all of the market, technical, operational, financial and human resource development needs and challenges, outline clearly the nature of partnerships required and secured for successful project implementation. Examples could include a selection of the following: commercial franchiser (e.g. a business with local operating experience); local merchants; telecom operator; Internet service provider; NGO and community organisation specialising in training; University; etc.
- **Risk and sensitivity analysis** – how is the project's performance and success affected by various market, sales, cost, pricing or operational scenarios, especially the worst cases.

8.2 Avoiding common pitfalls

The insistence on and scrutiny of project proponent business plans is an essential element to the avoidance of unsound projects being accepted and funded by Government or donor agencies.

The avoidance of *any one* of the above criteria could lead to inadequate project planning, management and performance. Several Telecentre projects especially seem to have been planned and approved without sound business plans or execution of same. The problem has been particularly well documented in the case of the multi-purpose community telecentres (MCTs) implemented by South Africa's Universal Service Agency (USA), although other projects have shown similar weaknesses. In particular, problems have arisen with:

- **Market analysis** – proper needs, demand, user preference and competition studies prior to the establishment and planning of MCTs are often missing
- **Appropriate size** – many MCT/ICT projects can be classed as “top down,” employing large capital resources and requiring complex management, without the revenues or skills to make them sustainable within a reasonable period. On the other hand, “bottom up” projects, scaled for profitable operation by small business people with some background and record of operating a tele-business successfully (e.g. a phone shop, grocery store owner) have more chance of financial success when they make the investment decisions. The correct balance between these two extremes must be decided through the business plan. On balance, the top-down model stands only a small chance of success, especially in a non-urban setting



whereas the bottom-up model can succeed and expand as its owner justifies incremental investment according to obvious demand and local knowledge.

- *Pricing and user costs* – pricing strategies and guidelines are often missing, and prices do not reflect the cost of providing the services.
- *Equipment amortisation, depreciation and replacement* – a recurring failure in ICT project planning (especially for MCTs) is to neglect the cost of equipment replacement. Failure to allow for amortisation and depreciation in the operating budget and to cover these items in the project income statement means that a project is destined not to survive past the first cycle.
- *Communications access* – too many MCTs have neglected the access problem. They have relied on or expected incumbent telecom operators to install initial or improved telephone and Internet access facilities, which never took place. Wishful thinking, poor project planning, co-ordination and management were to blame and clearly could not have been adequately covered by the business plan. A risk analysis could not have taken place. Hence the “tele” part of the vision has all too often failed dismally.
- *Human resources (training, compensation and motivation)* – many MCTs rely on volunteer work and managers often do not get compensated with an appropriate salary. This results in difficulties of retaining motivated staff long-term. Too many telecentre projects have failed because the management was even incapable or unmotivated to diligently collect revenues, pay the telecom operator and keep the lines working.
- *Central mission and vision* – some MCT projects have floundered because the core business planning issue of whether the centre is a social service or business was never clearly set out and executed.
- *Content and localisation* – Of course this is cited as a problem in developing countries, but needs to be resolved first with clear-headed, step-by-step ICT service targeting. It is a good reason for commencing modestly with services that are known to have demand – e.g. voice telephony, increasingly text messaging and, for more advanced ICT, identified needs such as computer training and education material for those who are sufficiently educated and can be trained to guide others.

All of these pitfalls, ranging from project design to execution, user fee collection and human resource training must be resolved through the diligent standard-setting and examination of business planning, and usually sound local-foreign and, if appropriate, public-private partnership.

8.3 Requirements specific to a small grant application

(e.g. for a School net access or telecentre project)

The following pro-forma ‘small business plan’ or information submission is an example for applicants to a UAF or donor program for small matching grants by ‘vanguard schools’, community groups, associations or commercial organisations wishing to start up an ICT project.

School/Institution/Company	Name of sponsoring organisation
Location	District, Town or rural administration
Contact	Name Title Address Phone & fax Email
Title of Project	(E.g. School network, telecentre, etc.)



Main objectives of project	Describe the essential vision of the project.
User community	Who the main users of the facility will be. If appropriate, show difference between initial phase (e.g. school) and second phase (e.g. outreach to community users)
Main benefits of the project	E.g. increase of educational resources for the school, access to more career information, business development opportunities for the community, etc.
Description of facilities to be provided/deployed.	Describe the scale of the network/centre (e.g. number of computers, printing, office services equipment, type of Internet access, etc.)
Ownership & Management	Describe who will be responsible for the financial, technical/operational and human resource aspects of the project. Explain who the manager and staff will be, and whether/ how much training is required, and how training will be conducted.
Capital costs	Computer equipment Network Communications Electrical power system Furniture Building/room/facility preparation Other
Operating costs	Staffing Communications/Internet Services Other
Costs already covered & by whom	Outline financial resources already identified
Partnerships & assistance secured	Describe any agencies, NGOs, companies who have agreed to provide financial, technical, managerial assistance, and describe the inputs.
Support required from the Fund	Capital cost Operating cost (maximum three years) Training Outline the required/suggested schedule of payments
Future sustainability	Explain how the project will be self-sufficient or profitable after the first three years.
Equipment depreciation and replacement	Explain how the equipment will be upgraded and replaced at the end of its life, and how this will be financed.
Services, revenues, community support & subscription	For projects that envisage public telecentre activities, explain the service and revenue structure Provide proposed fees for services Show how much public/ parent subscriptions, etc. or other fee bases will be used.
Other means of support	E.g. supporting agencies, NGOs, volunteers, etc.



Financial schedule	Provide a cash flow tabulation of costs, revenues and asset balance sheet, projected for at least five years.
Risks, uncertainties and other comments	Provide a brief discussion of the main risks to project success, and the challenges foreseen, the likelihood of their occurrence, and how the project sponsors will address them.
Expected date of inauguration	
Proposal assistance	Show whether assistance was received with this proposal and whether the assistance will be ongoing.
Name and Signature of preparing officer (Name)	(Signature) (Date)



9 FUNDING PRINCIPLES & PROCESSES

Overview: This chapter is addressing governments and policymakers who might decide to fund certain rural ICT projects, directly or through a UAF, and for donors and development agencies developing rural ICT funding programs. It is also for businesses or other organisations interested in receiving funding, to enable them to understand funding rationale and processes. The concept of 'smart subsidy' is introduced, the question of who should receive such funds, and the best principles to follow in distributing funds is outlined

9.1 Smart Subsidy & Best Practice

Funding (subsidising) rural ICT projects brings certain risks or dangers with it, which are:

- distorting the market
- creating dependency on ongoing funding
- possible abuse of the funds
- favouritism, and
- simple failure of a project and thus waste of resources.

To avoid these funding pitfalls a best practice approach has emerged called 'smart subsidy'. This is part of a broader approach to government subsidies known as Output-Based Aid (OBA). The OBA approach delegates service delivery to the for profit or non-profit private sector under contracts that tie payments to the outputs or results actually delivered to target beneficiaries.²²

A 'smart subsidy' is essentially an initial subsidy given to the private sector that is result-oriented, does not distort the market and encourages cost minimization and growth of the market. It helps to "kick start" a project or service with the objective of ultimately seeing the program to be commercially viable, whereas without the subsidy investors might otherwise have been reluctant to invest.

The term of smart subsidies appears to have been first introduced within the World Bank in 1998, during a Village Power '98 Conference in Washington DC, although the Chilean rural telecom fund was practicing the same principle since the introduction of its subsidy and rural license program. Addressing the issue that some existing subsidies were ill-designed, causing waste of resources, bottlenecks in development, and generally being counter-productive, the use of smarter subsidies²³ was suggested, to support the following guidelines:

- operate according to pre-established clear, explicit rules that are transparent and do not create distortions in the market;
- be linked to good results and support cost-minimization incentives, and
- facilitate good governance.

When considering 'smart subsidies' for targeted projects, the following concepts should thus be emphasized:

- **Competition:** subsidies should not be anti-competitive (as many subsidies that allocate funds only to one service provider tend to be), but should be offered to multiple users or service providers. Competition also aids cost-minimization efforts, taking the form of tendering where the winner would be the provider asking for the smallest subsidy.

²² See for details "Contracting for public services: Output-based aid and its applications" Edited by Penelope J. Brook and Suzanne M. Smith, published by Rapid Response Unit of the World Bank Group.

²³ Introduced by Subodh Mathus, originally called "smarter subsidy" the term is now commonly known as "smart subsidy".



- **Explicitness:** this facilitates good governance, whereas implicit cross-subsidies do not, since they have no clear and separate accounting procedures.

9.2 Funding/subsidy recipients

There are basically two sets of alternatives for subsidy disbursement or funding. These are:

- Direct (supporting the end user) versus indirect (supporting the service provider)
- Commercial (for-profit entity) versus non-profit organisation

Direct subsidies

Under the direct subsidy system²⁴, prices are allowed to signal true economic scarcity costs, with subsidies directly paid to the consumers who cannot afford to pay, rather than to service providers/operators. The direct subsidy approach is transparent and explicit, and minimizes price distortions within the utility companies.

There are generally three direct subsidy payment schemes for utility type services, namely:

1. a one-off payment to connect to the network - a connection fee subsidy
2. a continuing fixed or standing charge to remain connected, regardless of how much is consumed - a rental fee subsidy
3. per-unit charge directly related to consumption - a usage subsidy.

Administrative costs are often a problem with direct funding, as the costs do not vary significantly with respect to the size of the subsidy given. However, schemes that pay out very little to each beneficiary tend to be highly inefficient from an administrative point of view. For instance, in some simulations conducted in Panama, for a water consumption subsidy of US\$1.50/month, the administration costs absorb 40 percent of the total value of the subsidy. But in the case of a one-off sewerage connection subsidy of US\$750, the administrative costs fall to 7% of the subsidy value. This illustrates that low value subsidies are hard to justify administrative cost wise.

Some negative effects on the recipient can also be associated with direct subsidies: e.g. the non-payment syndrome, excessive use and poverty trap.²⁵

Because of the high administrative costs and the small amounts it is probably not recommendable to provide direct subsidies for telecommunications or Internet usage to end-users in African countries. However, a possible good example for direct subsidies are funding for schools, to assist them to add PCs, ICT training and Internet access. But it is recommended to subsidise only around 50% of the costs to avoid the negative effects mentioned above. Matching grants are a well-proven approach to funding in advanced countries at least and the principles are transferable to developing countries.

Indirect subsidies

Indirect subsidies are directed at the service provider and are the kind that can become candidates for 'smart subsidies'. This is because they are given to private sector players which are expected to continue the service on a commercial basis after the initial subsidy, thus securing the sustainability.

²⁴ Vivien Foster et al, *Designing Direct Subsidies for the Poor - A Water and Sanitation Case Study*.

²⁵ *Non-payment syndrome*: a subsidy that covers the full cost of the service will eliminate the incentive for efficient use. It is also likely to create a non-payment habit that the user finds hard to break away from. Therefore, full-scale subsidies should be avoided. *Excessive use*: a subsidy that applies to all levels of consumption may encourage excessive use of the service. One example cited in Argentina with a subsidy applied to a pensioner household had to be discontinued because consumption levels rose as family, friends and neighbors took advantage of the lower cost of using the utilities at the pensioner's home. *Time duration and the poverty trap*: the shorter the duration of the subsidy and the higher its absolute level or amount, the greater the chance that the potential loss of the subsidy may act as a disincentive for households to attempt to improve their economic circumstances.



However, an interesting pattern can be observed in the rural ICT field: in developing countries subsidies for telecommunications often indeed go to commercial telecom operators (often under the UAF mechanism), while projects involving more advanced ICT services are in many cases developed by NGOs and non-profit organizations.

The question a funding agency needs to answer is if and when it is justified to fund the private sector and when it should fund the not-for-profit sector. The following section will address the issue.

9.3 When is funding or subsidy justified?

This section is addressing the following key question:

- In which cases is funding justified?
- Should funding be made available for private sector players or for non-profit players, and in which cases?

Section 8.4 introduced the concept of what projects justify funding – i.e. those which are expected to have an economic that creates long term viability whereas they are financially marginal or risky in the short term. In general, where possible funding should be made to the private sector. This is because of the requirement of sustainability of projects: if a private sector player has a commercial interest of providing a service and has decided it is feasible with the assistance of the subsidy, it is highly likely that it will continue to provide that service.

An obvious question is: if a project is commercial, why does it need funding in the first place? There are two scenarios in which funding would be justified.

1. A project could make a profit but is considered only marginally viable and marginally attractive to investors in the short term, and/or low priority without the incentive of a rural subsidy.
2. A project will be commercially viable if high start-up costs (e.g. capital-intensive infrastructure) are (part)-funded.

Both of these cases *can* be justified, as the following examples illustrate:

Commercially viable in the medium to long run

A demand study and business plan could show that a certain rural region in a country would be able to turn a profit, but no operator would be interested to serve the area. It is important to define 'commercially viable' as there is a wide range, from barely viable to highly profitable. An operator who would serve the rural area might break-even (being operating cash-flow positive) in 5 or 7 years. This might be too long for some operators.

Put another way, the Internal Rate of Return (IRR) on the equity investment to serve a certain rural area could be considered too low for some investors, e.g. it could be only 10% whereas most investors look for at least 20%.

It is also important to consider whether the country has a fairly saturated market or whether the market is quite untapped. In a fairly untapped market, it is often more difficult to attract operators into rural areas as they have much more lucrative urban markets still to capture. In a more saturated market, operators are more interested in extending their reach and thus to add small incremental markets.

Last but not least, a market can be viewed as commercially viable, but present certain risks and uncertainties including lack of specific know-how or familiarity with rural areas by the service provider. These all act as disincentives and barriers to rural market development, which requires special measures to support and encourage the private sector to enter the rural market.



The same principles apply to ICT services, content and applications. In some cases, the risks for advanced ICT services are even higher as many of the products and services are new and untested.

Therefore, even in a scenario where a rural project can be considered commercially viable, it might still make sense to offer funding that attracts and incentivises commercial players to venture into the rural market.

The key challenge here is to establish a) whether a project is commercially viable, and b) how much finance is required to incentivise players. One could think this would require lengthy due diligence on the operators, or on ICT players' business plans, however this can be avoided. The most transparent method is a public tender with proper competition (ideally more than two players). Bidders would be required to ask for the amount of financial incentive they feel they require, against a maximum amount which the funding agency would be willing to give.

Funding options for commercially viable projects also could include non-subsidy instruments such as loans with lower interest rates than commercial banks, tax incentives, etc. They should always receive the most favourable (non-subsidy) regulatory support – such as assistance with the negotiation and setting of fair and cost-based asymmetrical interconnection agreements (see Section 6.1 for further discussion of this).

Commercially viable if high start-up costs are (part)-funded

There might be cases where a rural ICT project is burdened with very high start-up costs that are a barrier for business development. An example could be an e-banking solution: costs to develop/modify a software application and system tailored to rural banking needs might be fairly expensive for a small niche market with low margins. But once the application is implemented, a rural bank could run it profitably and could afford operation, maintenance and upgrades.

Not profitable projects

If a rural ICT project is expected to be unprofitable, that case could be divided into two categories:

1. A project will not make profit but will be able to sustain itself.
2. A project will not sustain itself without some form of ongoing funding.

If a project has no outlook to be profitable, it is unlikely that the private sector can be the major project driver. However, the private sector can be involved in a philanthropic way, even if possibly more sporadic. This would include in-kind contributions (e.g. PCs) or special discounts on services and training, employee volunteers, etc. These options should be used to minimise the expenses of a rural ICT project.

However, overall, projects that are commercially unviable or with insignificant profit margins must either be subsidised for the long run or be given to not-for-profit organisations which have intrinsic motives to develop the project.

If at all possible, rural ICT projects should be planned / selected and funded on the basis that the sponsors can demonstrate sustainability under conditions of ongoing responsibility (i.e. their commitment to provide resources) that are acceptable to them. If a project cannot sustain itself, this may be because it has a lack of support by the end-user community and other stakeholders and thus there is a risk of wasting resources.

9.4 What are the best financing and funding principles?

Capital versus operating costs funding

In line with the smart subsidy principle described above, it is preferable for indirect subsidies to the private sector to finance only the capital costs. Alternatively, once-only funding packages that cover capital cost and part of the project's early operating expenses, can be made on the basis



that the project becomes self-sustaining once the start-up (e.g. first two years') operating costs have been supported.

Sponsor participation

In all cases, experience shows that it is crucial that funding is structured such that sponsors are required to mobilise a significant portion of the project finance and total resources, typically at least 50%. This could be a combination of in-kind contributions and possibly ongoing costs. Whether given to the private sector or to not-for-profit organisations, grants should thus be given on a matching basis, i.e. whatever amount the project sponsor can mobilise himself is matched by the funding agency.

Funding of supporting measures, e.g. training

In many cases rural ICT projects require supporting measures such as training end-users or recipients, this could also be a focus for funding.

9.5 What are the best-practice processes for funding?

There are three main processes for selecting qualified and effective fund recipients:

1. Public competitive tendering
2. Public invitation to apply for funds (on first come, first served basis), and
3. Funding project sponsors (which have approached the funding agency with project proposal).

1. Public and competitive tendering

This concept has been used in the UAFs described earlier and there are more detailed descriptions and discussions available on how this process works for a UAF.²⁶ However, it contains several useful principles that are effective in similar cases where selections of which rural ICT projects to fund must be made. It is recommended in cases where the development agency or donor has a specific (larger) rural ICT project in mind and needs to determine which provider, consortium or organisation is the best qualified to develop, implement and operate the project. It encompasses the following key elements:

- Bid objective
- Public consultation with stakeholders and potential bidders
- Preparation of bidding documents
- Transparent bidding process
- Qualification & evaluation

Bid objective

The funding agency needs to clarify its bid objective at the outset. For example in the case AC is funding the start-up of a company developing and supporting PCOs run by village entrepreneurs, the objective could generally be described as follows:

- To select a qualified organisation (experience, personnel etc.)
- with necessary capacity (own capital, support 'network' reaching rural areas, etc.), and
- long-term motivation (sustainability, business plan), while
- minimising the funding required.

²⁶ See Edgardo Sepulveda, Model Universal Service Fund - Policies and Procedures, Part II: Minimum Subsidy Auctions for Provision of Public Access Telecommunications in Rural Areas, CTO & ITU 2002



More specific objectives describe what the planned rural ICT project should accomplish: in the example above, this could be described as:

- providing one PCO in every village with more than 2,000 inhabitants in the northern province within 2 years²⁷.

Public consultation with stakeholders and potential bidders

It is good practice to engage in public consultation before and during a competitive tendering process. To start, it may be useful for a funding agency to hold a public workshop, proposing their rural ICT project and the competitive tendering process, and invite public comment on the objective and approach to be taken. Consultation allows the project sponsor to receive the views of consumers and prospective applicants on a proposed initiative. Project objectives and the tendering can be fine-tuned to maximise the prospects for a successful rural ICT project.

Preparation of bidding documents

Once the objective and approach has been refined through public consultation, bidding documents for distribution should be developed, specifying the targets of the project as well as the qualifications expected.

Bidding/Tender documents should include the following elements (Guideline and not necessarily exhaustive)

Specific licensing provisions	Reference to relevant sections of the enabling Law (e.g. Communications Act, Telecommunications Bill)
Operating area	List the specific areas(s) for each licence
Minimum service obligations	State in tabular fashion: <ul style="list-style-type: none"> • the number of public telephones required for each area • the required in-service dates • any other 'universal access' requirements or obligations
Quality of service obligations	State all minimum quality standards which must be met such as: <ul style="list-style-type: none"> • in-service % of year for public and private lines • minimum and mean time to repair • dial-tone delay
Monitoring and reporting obligations	Provide format and timing for reporting of in-service and operational statistics. State UAF monitoring rights and expectations
Mitigation & Penalties	Outline clearly all measures that must/will be taken to mitigate non-performance and relevant schedule of penalties
Market protection	State clearly whether or not the existing incumbent operators have the right to enter & compete in the licence areas State clearly on what date the market could be opened to further competition
Market rights	State the extent of freedom which the operator will have to provide telephony, data and Internet services, both in the licensed areas and nationally
Technology specification	State any technology requirements, such as: <ul style="list-style-type: none"> • whether or not all transmission media are allowed (e.g.

²⁷ These objectives should obviously be based on realistic targets, based on demand analysis described in Chapter 5.



	including VSAT) <ul style="list-style-type: none"> • whether or not IP telephony will be an allowable technique
Radio frequencies	State clearly the policy on radio spectrum usage, radio frequency co-ordination, and the process required for radio frequency approvals <ul style="list-style-type: none"> • Any frequency bands which are definitely not going to be allowed (e.g. E-GSM) should be declared • State the likely policy on radio frequency licence charges
Cost of licence	Outline all possible licence fees and levies
Tariffs	Clear statement of the tariff rules – typically maximum allowable and formula for subsequent price cap.
Interconnect	State the physical interconnect rules/rights, and any other details of interconnect agreements Indicate the schedule for any subsequent cost-study, and potential changes to the interconnect formula.
Maximum subsidy	State the maximum subsidy allowable and show clearly whether the subsidy is calculated on a total licence or area-by-area basis.
Licence Subsidy contract	Draft contract between UAF and successful bidder. Show clearly all conditions and how the agreed subsidy is divided between the down-payment, progress payments and final service guarantee hold-back.
Bid bond and/or Performance guarantee bond	Description of terms and conditions
Demand data	Share any demand data

Transparent bidding process

Transparency requires that the process should be conducted openly and that the selection of the winning candidates be based on criteria published in advance. Key features of transparent processes include:

- advance publication of the bidding documents, with process rules, qualification and selection criteria;
- separation of qualification and selection processes;
- public opening of sealed financial offers from qualified applicants.

It is good practice for a funding agency to take all reasonable steps to ensure that participants in the competitive processes, as well as the general public, perceive the process to be fair.

Qualification & evaluation

A two-stage procedure for the selection of a successful candidate for rural ICT projects is preferable.

- ▶ Stage 1 clearly identifies the required qualifications an applicant has to meet
- ▶ Stage 2 is the competitive price bid.

Generally, qualification criteria should be limited to ensuring applicants have the financial and technical resources and experience to successfully develop and execute the planned project.



It is important to establish clear, rigorous and proportionate qualification criteria. Depending on the planned project, the qualifications may vary, but need to be developed by the funding agency. The input from various interested bidders might help to clarify key qualifications, since the most appropriate qualifications may vary from country to country, with market size, etc.

The second stage would be related to the least amount of subsidy required by the bidders. All bidders considered qualified and having met the publicised qualification criteria will be evaluated in the second stage only with regard to the amount of funding they require. The lowest bid for funding/ subsidy wins.

2. Public invitation to apply for funds

This funding process is considered more appropriate if the objective is to disburse a large number of smaller amounts to a large group of people/organisations. E.g., this could be applicable to funding Internet access for rural schools (after the backbone infrastructure is available) or for funding the start-up of individual Internet access points/ telecentres.

Similarly to the process described above it would go through the same sequence:

- Project objective
- Public consultation with stakeholders and potential applicants
- Preparation of application forms
- Transparent invitation process
- Qualification & evaluation

The difference would be that there is no elimination process other than meeting the set qualification criteria, and likely a maximum number of recipients, e.g. 200 schools.

The approval process typically requires the preparation of an acceptable business plan (see Chapter 7) that outlines the sponsor's vision, objectives, need for funding, and demonstrates long term sustainability.

3. Funding project sponsors

Under this process, a project sponsor approaches a funding agency with a project proposal. In some cases the project sponsor is required to submit a formal application to receive funding. This funding process is clearly less transparent and rigorous in its selection. It lacks the benefits of a public consultation that could refine the rural ICT project idea and identify either obstacles or synergies with other organisations or initiatives. It often relies solely on the information provided by the project sponsor and is seldom cross-checked. It also lacks the element of selection and transparency as there is no process where a possibly better qualified entity could be made aware of the funding opportunity.

However, this funding approach is widely used and is partly to blame for the fact that sub-optimal rural ICT projects are sometimes funded. Nevertheless, in some cases this approach might have merit, for example for small pilots to test an idea.

In any case, funding should be contingent on the project sponsor submitting a business plan that clearly describes the project vision, objectives, costs, revenues, resources already mobilised, funding requirement, and projected sustainability.

9.6 How and when to disburse funds

Schedules for disbursing funds need to be carefully designed and tailored to the specific rural ICT project in question. On the one side, subsidies should not simply be paid out at the beginning of a



project. This leaves the funding agency vulnerable to abuse, e.g. the recipient will take the finance but not develop the project according to specifications, or not at all. On the other hand, if the finance is only provided after completion of a rural ICT project, that leaves the recipient without the funding to implement the project. Thus a careful balance of start-up disbursement and payment against milestones needs to be designed. Again, it is useful to discuss this in the public consultation process to better understand the requirements of the project execution from potential bidders.



10 MONITORING AND EVALUATION

Overview: This chapter focuses on monitoring, which is traditionally a neglected area. The lack of monitoring against project objectives, expected inputs and outputs, is responsible for many ICT projects having poor performance, whereas a monitoring process can flag and address issues and maintain project integrity. This chapter provides a summary of best practices for monitoring - planning and tools – as well as the evaluation of rural ICT projects. The emphasis is placed on monitoring.

10.1 Importance of monitoring

In one of the audits on the telecentre project of the Universal Service Agency (USA) in South Africa,²⁸ it was considered that the lack of monitoring was a contributing factor to its failure. There was no proper monitoring system in place either by the agency or by other donors that co-funded several of the telecentres.

Clearly, a good monitoring system is important to the success of any rural ICT project. Key reasons for monitoring are the following:

- If disbursements of funds are tied to milestones, monitoring needs to establish if targets have been met and the service provision is satisfactory.
- Monitoring should act as an early warning system and detect potential abuse and/or difficulties, and help to address and rectify the problem early in the process.
- Monitoring can provide feedback to the design of other projects, reduce the cost and/or increase the efficiency of post evaluation studies, thus improving the learning cycle for strategists and planners.

Thus, a monitoring plan should *already be included* in the rural ICT project planning and development process. This includes a description of what should be monitored and why, the timeline for monitoring, the resources required for monitoring, the responsibilities of the project owners/participants and how the results of the monitoring process are recorded and used.

There is a cost involved, but monitoring is as important as the initial stakeholder consultation and the payback in terms of project performance should be significant.

Finally, overall monitoring can be strengthened when monitoring and enforcement mechanisms are built into the regulatory framework and become part of the licensing requirements. Hence the following practices can be considered both at the regulator and project sponsor level (which in some cases of course may be the same).

Best practice of monitoring: planning and tools

An important part of the monitoring function would be to create and maintain a system that comprises the following:

1. **an up-to-date and reliable database of all the project's facilities and services, including** service roll-out status, service quality and possibly usage statistics
2. **pro-active assessment of performance** through a combination of:
 - field visits
 - basic user and project owner interviews (on a routine basis), and
 - telephone surveys as appropriate

²⁸ Add the source



3. **a process for filing and resolving** of customer or project-owner complaints/difficulties and comments
4. **open communication process** (e.g. through regular meetings) between funding agency and project owner on the process and progress of the project

The database and data input process should be managed and updated by the funding agency with the requisite data supplied through a system of reports and service checks to maintain relevance. The database could be quite ineffective if not managed by staff dedicated to that role. The staff must be capable of managing the database and identifying exceptions/issues requiring action and resolution.

The inputs can come from external sources through:

- forms and procedures established by the funding agency already in the planning stage of the monitoring system, which are part of the responsibilities of the project owner
- own or outsourced personnel contracted to collect, analyse and supply data

Reporting - project sponsor responsibilities:

A key tool that should be established from the beginning, and defined and specified in the subsidy contract, is a requirement for regular (e.g. quarterly) reports. Recipients/project owners should be responsible to file regular reports, showing project status, in order to keep record of project development.

Categories for reporting could typically be that shown in Table 1 below (but should be tailored to the specific rural ICT project and its requirements).

Table 1: Project Status Report	
Description of infrastructure/equipment installed and in operation	<ul style="list-style-type: none"> • Public phones • Internet access points • Etc.
Percent completion	<ul style="list-style-type: none"> • % of project complete
Services offered & prices charged (broken down by each service offered)	<ul style="list-style-type: none"> • Telephony • PC training • E-mail • Assisted Internet search • Etc.
Description of users and usage	<ul style="list-style-type: none"> • Total population covered (e.g. village) • Type of users • Frequency of use • Etc.
Revenue collected	<ul style="list-style-type: none"> • Broken down by services
Monthly operating costs	<ul style="list-style-type: none"> • Rent/ building • Salaries • Maintenance/repair • Supplies • Etc.
Financial status	<ul style="list-style-type: none"> • Profit/loss



Whereas the specific nature of the form should be defined in the project documents, and be completed and submitted by the project owner, the funding agency should develop a system to scan, review, identify issues and transfer data to the central database.

Evaluation of rural ICT projects

There are several subjects of evaluation depending on what the purpose of the evaluation is, and each evaluation will look different depending on the specific objectives and focus of the sponsoring agencies. This sub-section provides just the fundamental principles to consider in the context of a program or policy framework that is aimed at *accelerating* rural ICT development on an Africa-wide basis.

In this context, the most fundamental evaluation topics, as to a project's success, are the following:

1. Sustainability

The market and financial aspects of this can be assessed fairly easily if the preparation of a business plan was part of the qualification process (which it should be) and a monitoring system is in place. Basically the cost and revenue data collected from the monitoring need to be compared with the business plan, changes incorporated and their impact assessed.

Of course many aspects of sustainability relate more to the developmental components of content, application, capacity building and human resource development. However, as noted previously, these should also be addressed in the business plan as essential enabling considerations, rather than as isolated issues. They should also thus be continually monitored for execution.

2. Purpose and target

This is much more complicated and depends to a large extent on the particular project, for example an e-health project will have a different purpose than a schoolnet project, e-banking or a chain of PCOs. This type of evaluation is really addressing the impact a rural ICT project has. The intended or expected impact should be defined and described as specifically and concretely as possible at the outset in the planning and development phase, as described in Chapter 8.

In general, rural ICT projects are expected to have a positive impact on socio-economic development and poverty eradication. However, as noted previously, a monitoring and polling of achievement against expected outcomes is vital, in order to assist with evaluation.

An effective monitoring system, feeding good evaluation, will provide feedback on how effective the project targeting or coverage is. I.e. how well does the project reach those in need and avoid errors of exclusion. The rationale of implementing a funding subsidy is to distribute a service to those individuals, communities or areas that are not currently covered. If target groups or areas identified in need are excluded, the mechanism is operating below ideal.

3. Replicability

A specific facet of the African Connection ideal is to evaluate how transferable and replicable to other situations, markets and cultures within Africa a project is likely to be.

It is thus important to consider universal as well as specific factors that contribute to the success or failure of the project and, as a matter of routine, include an analysis of whether the project can be replicated, in both the planning and monitoring / evaluation process.



ANNEX A: DEFINITIONS & GLOSSARY

This toolkit covers a set of technologies, services, terms and issues that are elements or part of the world of Information and Communications Technology (ICT). The following provides a basic understanding of technical, non-technical and “buzz-word” terms used in the document and in the ICT business. Further details of some technical terms and infrastructure concepts are provided in Section 4 and of technology in Section 5.

Backbone	The primary transmission network of a telecommunications service provider.
Capacity building	The working and training practices designed to support and develop the human resources of an organisation, company or potential user group
CDMA	‘Code Division Multiple Access’ is a wireless technology competing with GSM for mobile market share (though hardly at all in Africa) and also one of the most common technical standards for fixed or ‘limited mobility’ wireless-local-loop telephony systems.
Datacasting or Multicasting	Datacasting facilitates the transmission of large volumes of information to multiple field offices or remote locations where traditional terrestrial communications infrastructure is expensive, unreliable or non-existent. It can also be used to provide wireless data communications at acceptable quality levels over an existing voice infrastructure such as terrestrial wire-line or mobile wireless network. Closed-User Group customers such as a school, a business, or a government department with scattered field offices can be connected to the system at low cost.
Digitalised network	A digitalised network is a network (whether fixed-line, fixed wireless or mobile wireless) that utilises digital rather than analog switching and transmission techniques. This involves translating information (voice, or data) into binary codes. Digitalisation greatly improves system capacity, quality of service, and services that can be offered. Digitalisation of mobile wireless networks comprised the second generation (“2G”) of mobile wireless technology.
Distance education	The practice of studying educational material, usually for the purpose of obtaining an accreditation, diploma, or degree, using the public Internet.
e-commerce	The purchase or sale of goods and services using the public Internet. The advent of e-Commerce using a mobile telephone has led to the creation of a related term, m-Commerce.
e-government	The conduct of business with government using the public Internet. Examples of e-government would include the transmission and submission of forms, provision of online information about property deeds, laws, legislative or electoral procedures, voting, etc. as well as online government procurement.
e-health	The provision of health care services using the public Internet. This may range from medical information and enquiry services for health professionals to online video-based remote consultations and diagnostic services.



e-learning	The provision of educational services using the WWW and the public Internet. Can also apply to computer-based training.
GSM & GPRS	<p>Global System for Mobile Communications (GSM) was developed in association with the European Commission, European equipment vendors and other industry participants to standardise mobile communications technology in Europe. First launched commercially in 1991, GSM is now the most widely adopted mobile telecommunications standard in the world, and is almost universally the standard used in Africa.</p> <p>GPRS – General Packet Radio Service - was introduced only in mid-2001, mainly in advanced country urban markets. It allows a handset to be permanently connected for data usage without being charged for the time of the connection. Charges are only incurred when actual data is sent or received. The other main advantage of GPRS is that it is capable of receiving data up to 3 times faster than a normal handset. This makes GPRS ideal for connection to corporate servers and for use with WAP. However, the availability of GPRS in Africa to date very limited and may not advance rapidly due to the cost of upgrading the existing mobile infrastructures.</p>
High speed wireless	High speed wireless as used in the Toolkit refers to fixed terminal wireless, generally used to provide Internet and other data transmission connectivity at transmission speeds in excess of normal dial-up, typically commencing at 64kbps. Some systems in this category are relatively inexpensive “wireless routers” or “wireless LANs” (local area networks) that enable extension of the Internet from an access point (e.g. an existing radio tower connected to the national infrastructure) to any number of users within line-of-sight of the tower or of one another.
Information and Communication Technology (ICT)	Information and Communications Technology (ICT) encompasses a wide range of infrastructure, services, content and applications, from traditional telecommunications, the Internet, various media such as radio & TV broadcasting to advanced IT equipment and applications. The term has shifted from naming the numerous <i>technologies</i> involved into a catch-all phrase encompassing as well all the communication and information <i>applications</i> and <i>services</i> enabled through the technologies. ICT is a term particularly used by the development community.
Informatics	The application of computer, information technology and statistical techniques to the management of information. This term is often linked to the specific application to which the technology is being applied – e.g. health informatics, medical informatics, bio-diversity informatics, etc.
Interconnection	The practice of connecting different telecommunications networks together in order to enable subscribers of each network to call and speak to subscribers of the other networks. Note that it refers to both physical interconnection and the system of ‘wholesale pricing’, access charges and/or revenue sharing between operators. This is often a subject of controversy and effective resistance by incumbent operators to new competitive market entrants. Interconnection policy is also a critical factor in enabling rural telecommunications services to be profitable (see Section 3.4).
Internet POP	Point of Presence (POP) is the physical location of network element(s) to which subscriber equipment, or another network, can connect to the



	Internet. The difference between this physical location and, say, a 1-800 number termination is that the 1-800 number can be terminated in numerous locations whereas a POP is fixed in a specific location. However a POP also allows high-speed access and more advanced forms of Internet access than simple dial-up.
Liberalisation	Liberalisation is a legal and regulatory process undertaken by Governments to open up markets to new entry and/or competition. Initial conditions required for liberalisation include corporatisation and sometimes partial or full privatisation of the national operator owning the public switched telecommunications network (PSTN). Liberalisation actually occurs when network operators other than the incumbent operator are licensed by Government and permitted to build and operate networks offering services in competition with the incumbent operator(s).
Output-Based Aid (OBA)	Output-Based Aid (OBA) is a specific approach to government subsidies. The OBA approach delegates service delivery to the for profit or non-profit private sector under contracts that tie payments to the outputs or results actually delivered to target beneficiaries. Subsidies given under the OBA concept are often called 'smart subsidy' (see below).
PCO	A Public Call Office (PCO), also sometimes known as a phone shop, phone kiosk or 'teleboutique', is a facility with a working public telephone that is operated by a person who receives a share of revenue for their services.
PSTN	Public Switched Telecommunications Network (PSTN) is, in many countries, either an asset operated by the Ministry of Posts and Telecommunications or is the first telephone company to provide service in the country. The PSTN is usually built using a terrestrial wire-line network.
Smart subsidy	An initial subsidy (usually given on a once-only basis) that is designed to be result-oriented, does not distort the market, and encourages cost minimization and growth of the market. It helps to "kick start" a project or service with the objective of ultimately seeing the program to be commercially viable, whereas without the subsidy investors might otherwise have been reluctant to invest. Their reluctance could be due to perceived risk or general lack of capital for the kind of opportunity promoted by the sponsors of the subsidy fund.
SMS	Short Message Service is a service that enables text messages of up to 160 characters to be sent from one mobile phone to another mobile phone or from the Internet to a mobile phone. An important characteristic of SMS is that, while it is similar to a store and forward system, delivery of the message is guaranteed.
Tariff rebalancing	The process of increasing PSTN monthly subscription and local call tariffs and reducing long distance and international tariffs in order to align the prices charged to consumers with the costs incurred by telecommunications operators. This process is generally a requirement to enable competition to take place in the telephone service market.
Teleboutique	The term adopted by Morocco to denote a PCO or phone shop offering public payphone services.
Telecentre	A public access centre providing in addition to pay telephone and fax as a minimum e-mail and public Internet access, and possibly a range



	<p>of other ICT services, such as photocopying and other business services, PC training, public broadcast and video viewing, distance education sessions, etc.</p> <p>To avoid confusion, the Toolkit does not use the word telecentre to describe cases that have only telephone and fax services. These are called PCOs or phone shops. For the purposes of the Rural ICT Toolkit a telecentre must offer at least e-mail and public Internet access.</p>
Universal Access (UA)/ Universal Service (US)	<p>Universal Access (UA) is the policy objective to provide convenient and affordable communications access, on a community basis, through public access facilities such as payphones and telecentres to the whole population. Often in many countries there are already public payphones, PCOs and phoneshops in larger urban centres, thus a UA strategy often focuses on rural areas.</p> <p>UA is the forerunner to Universal Service (US), which is the objective of making facilities available individually, to every household for a reasonable price. This is mostly the policy objective in OECD countries, although some developing countries refer to their <i>UA strategy</i> also as a US policy.</p>
US/UA/Rural Fund (UAF)	<p>The universal access fund (UAF) is a generic name for a telecommunications development fund. This is becoming a widely accepted mechanism for mobilising <i>private sector</i> investment into high cost areas, within a liberalising environment. UAFs usually focus on rural network access and are sometimes named to reflect this. UAFs typically offer once-only start-up subsidies for designated areas. See Section 3.4 for more.</p>
VoIP	<p>Voice over Internet Protocol (VoIP) means the transmission of voice calls over an IP packet network – that used by the Internet - rather than a circuit-switched network. VoIP is growing very rapidly for international long distance transmission. It usually offers greatly reduce call prices but currently provides lower quality of service than circuit-switched networks due primarily to latency (delayed reception) and transmission failures (lost packets).</p>
VSAT	<p>Very Small Aperture Terminal satellite (VSAT) systems consist of one master earth station and numerous two-way satellite terminals. The voice can be private or public switched telephony; the data can be private or public Internet. VSAT technology is widely used by resource or other multinational firms and far-flung organisations for long distance data, voice, and fax transmission where terrestrial systems are unavailable or unreliable.</p>
WAP	<p>Web Access Protocol – a suite of technical standards developed to enable mobile phone users with compatible handsets to browse the Internet and access a range of information services. To date the WAP-enabled handsets have been relatively expensive and WAP services limited. As mobile phone screens tend to be small and the service is slow, it is normally purely a text service. GPRS has greatly enhanced the uses of WAP due to the increased access speed, but of course the coverage of GPRS in Africa is currently limited to a few urban areas.</p>
Wireless Local Loop	<p>The provision of a connection between the subscriber's terminal equipment and the telecommunications network using radio waves rather than wiring. Usually refers to fixed wireless network applications (e.g., PSTN) rather than mobile wireless network applications.</p>



ANNEX B – BASIC RURAL ICT EVALUATION MODEL

See separate Excel spreadsheet



ANNEX C – GRAMEEN TELECOM CASE STUDY

Overview

Grameen's Village Phone (VP) program in Bangladesh is a well-documented case illustrating how telephone service can be extended to low income rural dwellers. VPs are public access GSM phones that are owned and operated by local women entrepreneurs in villages throughout Bangladesh. Financial assistance for purchasing a GSM phone is provided by Grameen Bank, a microfinance institution. Once an entrepreneur has acquired a phone, she can then offer mobile payphone service at her shop, home or at the local market. Bulk airtime is purchased by non-profit VP sponsor, Grameen Telecom (GTC) at a discount from the for-profit GSM operator GrameenPhone (GP). The airtime is then resold to the VP operators at a rate significantly below retail tariffs.

The VP program witnessed rapid growth during 2002, nearly tripling the number of subscribers. As of the end of 2002, 23,000 VPs were in operation around the country. The VPs operate in over 21,500 villages. The VPs in operation presently provide access to telecommunications facilities to some 40 million people in remote, rural areas.

Average usage of VPs is around 1600 minutes per month, out of which 600 minutes are outgoing calls. This usage pattern is notable for its asymmetry – that is, there are substantially more incoming minutes than outgoing minutes. The call mix seen with VP reflects a pattern that is prevalent in other parts of the developing world – urban residents with friends and family in rural areas will disproportionately initiate calls to their rural contacts – likely due in part to the higher average income of urban residents.

There are many factors that contribute to the success of the VP program, some of which are unique to Grameen and Bangladesh and will be difficult to replicate. One of the keys to making the VP program work is the relationship between GP and GTC. It is essential that GP provide airtime on its network to GTC at a substantial discount. Otherwise, there would not be sufficient margin to allow the VP operators and GTC to be financially viable. As well, since GTC is a non-profit, it is only seeking to cover its costs when it resells airtime to its VP operators and is not concerned with profit. This enables the VP operator to provide affordable service and still earn a reasonable profit.

Another important characteristic of the Grameen model is the role of GB. With branches covering 41,000 villages throughout Bangladesh, GB provides GTC and its VP operators with services such as bill collection and assistance with phone-related problems. This relationship means GTC is spared the expense of developing its own points of presence in all areas where it provides VP services.

Three characteristics of Bangladesh itself are also important to Grameen's success: 1) Bangladesh is one of the most densely populated countries in the world; 2) the flat, alluvial plain that constitutes most of the country's land area is relatively inexpensive to cover with a mobile signal; 3) over 74% of the country's population lives in rural areas.

Country background

Bangladesh has a population of over 131 million (2001) and a population density of 912 per km². Over 74% of the population lives in rural areas. With a GDP per capita of US\$ 351 (2000), The UN considers Bangladesh one of the 49 "least developed countries".

Many people in Bangladesh live and work outside their villages. In addition, 50% of rural households do not own any land. They seek off farm and non-farm income earning opportunities outside their villages. Labour mobility has increased enormously in the recent past. On the other hand, the volume of rural-urban trade has considerably increased. Enhanced labour mobility and



the importance of marketing agricultural products have key factors in high demand for telephone services in rural parts of the country.

With a teledensity of just over eight phones per 1,000 residents, the majority of the rural inhabitants living in the country's 68,000 villages do not have convenient access to telephone service. The main fixed-line telecom operator is the Bangladesh Telegraph and Telephone Board (BTTB). There are four mobile operators, including GrameenPhone.

ABOUT GRAMEEN

Grameen Bank

In 1976, Professor Muhammad Yunus and his colleagues started the Grameen Bank (GB), a micro-finance institution. GB provides credit to the poor in rural Bangladesh without any collateral. As of September 2002, GB had 2.4 million borrowers, 95% of whom are women. With 1,175 branches, GB provides services in 41,000 villages, covering more than 60% of the total villages in Bangladesh.

Grameen Telecom

Established by Grameen Bank, Grameen Telecom (GTC) is a not-for-profit company. GTC is dedicated to extending the telephone service to the rural people of Bangladesh. Currently GTC provides GSM 900 cellular mobile phones to villagers via GrameenPhone's (GP) network. GP is 35% owned by GTC. GTC's ultimate goal is to provide telecommunication services to the 100 million rural inhabitants in the 68,000 villages in Bangladesh.

GrameenPhone

GrameenPhone Ltd. (GP) is a GSM 900 mobile phone provider that began operating in 1997. The Bangladesh government did not charge GP an up-front licensing fee. GP has two tiers: it provides mobile phones and service to urban customers, and it sponsors the VP program. GP's subscriber-base increased from 470,000 in December 2001 to more than 750,000 at the end of 2002.

In 2001, GP made US\$ 27 million in pretax profits. It turned that profit after just five. Investment through 2002 totalled nearly US\$ 200 million. GP's network continued its expansion around the country during 2002 and now has coverage in 50 districts including all six divisional headquarters. Rangpur, Dinajpur, Lalmonirhat, Gaibandha, Sherpur, Netrokona, Chandpur and many other new areas came under the coverage of the GP network during the year.

Shareholders in GrameenPhone

- Telenor (51%)
- Grameen Telecom (35%)
- Marubeni Corporation (9.5%)
- Gonofone Development Corp (telecom development company based in New York) (4.5%)
- International Finance Corporation (3% of the preferred shares)
- Asian Development Bank (3% of the preferred shares)
- Commonwealth Development Corporation (3% the preferred shares)

Grameen's structure

GB created two related entities to manage its telecommunications activities. GTC is a wholly owned non-profit organisation that runs the VP program in rural. GP operates for profit and is



Bangladesh's largest national GSM mobile operator. To ensure that GP rolls out its network in rural areas, GTC invested in a 35% equity stake in GP, financed by GTC borrowings. In exchange for this funding, GP has committed to developing the network in rural areas.

VILLAGE PHONE

The "Village Phone" (VP) concept was developed by combining GB's experience with the village based micro-enterprises, digital wireless technology, public call offices (PCOs) and privately operated phone centres. A GB micro-finance client obtains ownership of the phone under the lease-financing program of the bank and provides the services to the people in the adjoining area. The VP bills along with its other dues are collected by GB. Grameen hopes that VP will soon become the largest wireless pay phone project in the world. They aim to install 40,000 VPs by 2004.

Each mobile phone remains under the custody of a VP operator, who is responsible for extending the services to customers for both incoming and outgoing calls, collection of call charges according to prescribed rates and proper maintenance of telephone set. The operator's income is derived from the difference between the air time charges paid by customer/s and the billed amount required to be paid by the VP operator along with a flat charge for each incoming call.

Expenditure and Earnings

Purchase & Payment

The basic VP package contains a Nokia 5110 handset, battery, fast charger, sign board, user guide in Bangla and price list for different calling destinations (both local and international). The basic package costs Taka (Tk.) 12,000 (US\$ 220). The GB branch pays the bill to GTC while the VP operator pays GB in weekly instalments. For usage charges, VP operators pay a minimum monthly bill of Tk. 154, which includes monthly line rental, VAT and service charges along with Tk. 100 towards the annual government license/royalty fee. Actual airtime charges are then added over and above other fees.

Call Charges & Profit

GP charges Tk. 2.00 per minute for local calls at peak hour (compared to Tk. 4 for urban subscribers). For long distance calls, GP charges the BTTB rate plus VP air time charges. 15% VAT is added to the total call charges. To compensate the administrative costs incurred by GTC and GB, a 15% service charge is added to the total GP bill. VP operators are supplied with a price list that includes all kinds of charges and a margin of profit for themselves. For example, for a local mobile call, the retail rate is Tk. 5.0, out of which the GP cost is Tk. 2.0, VAT is Tk. 0.30 and the service charge is Tk. 0.30. Therefore, the remaining Tk. 2.40 is profit for the VP operator.

Administration

Selection, Subscription and Training

On getting information about coverage from GP, a GTC Unit officer visits the GB branches in the area and prepares a list of villages where network coverage is satisfactory, towards providing VPs. The GB branch then selects from among its better performing members from these villages to act as the VP operators. GB has specific criteria for selection of VP operators. Some of these rules are:

- She must have a very good repayment record of GB loans;
- She should have a good business, preferably a village grocery store and has the spare time to function as the VP operator. Initially this would constitute a side business and eventually she would switch over to telecom business on a full time basis, after services and revenue justify full time commitment;
- She should either be literate herself, or she must have children who can read and write;



- Her residence should preferably be situated near to the village centre.

After initial selection by the GB branch as a potential VP operator, a Unit Officer of GTC verifies signal availability at her house or shop where she intends to use the phone. After final selection, GTC subscribes to GP's service and provides connection to the member. GTC supplies the necessary hardware and provides training to operate the phone. The price of the phone and the connection fee is paid by GB to GTC while the micro-finance client pays it back in instalments to GB, within a two or three year period, as decided on a case by case basis.

Billing

GTC purchases from GP bulk airtime for all VPs in operation at a specially discounted rate that has been negotiated between the two organisations. GP prepares the monthly bills and sends these to GTC for payment. GTC remakes the individual bills (in Bangla, the local language) and sends these to the corresponding branch with a summary of all bills due from a particular branch. The concerned branch then pays the bill to GTC over the next six weeks period. GB in turn collects the bills from VP operators.

After Sales Support

The Unit Office of GTC is responsible for the VP operation in the field. The duties of the Unit Office are to locate new areas with signal coverage, help GB branch managers to select members to become VP operators, train the VP operators and take care of problems faced by VP operators regarding handsets, billing etc. So far, there are 13 Unit Offices in: Dhaka, Norsingdee, Srinogar, Comilla, Feni, Chittagong, Mymensingh, Sirajgonj, Khulna, Barisal, Sylhet, Rajshahi and Faridpur. The number of Unit Offices is planned to expand with the increase in signal available area.

Experience and Impact

VPs enable villagers to make and receive calls from their own villages. VP operators have a financial incentive to make the extra effort to find the person for whom the incoming call is destined.

From the phone, average net income of the phone lady is around Tk. 2,500 to Tk. 5,000 per month (US\$ 50 to 100). The amount is quite attractive when compared to other rural occupations. With the completion of the network, 40,000 VP operators are planned to be employed for a combined net income of \$24 million per annum (assuming a 20% increase in airtime use).

The operators also have the phone numbers of the local MP (Member of Parliament), police stations etc. VP may provide phones to the local Police Station, Hospital/Health Complex, Agriculture Office, Family Planning Office, Fire Stations, etc. where the villagers could call for help.

Obstacles Faced

Most of the villages that have VPs are situated at the outer edges of cellular coverage. Sometimes signals fluctuate. This results in frequent dropped calls, loss of revenue and customer dissatisfaction. Grameen has introduced external High Gain Antenna to ensure smooth call completion in areas with weak signal. This also extends coverage for VP operations without further investment in network expansion.

Power for charging batteries is another problem. There are villages with network coverage, but without electricity. The number of such villages will increase the further one moves from Dhaka city. Grameen has tested solar panels and DC batteries as alternative power sources.

All the solutions of the present problems (i.e. extended antenna, solar panels, DC batteries) increase start up costs, which are funded by a GB branch. This results in increased weekly payments for the operator.



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ANNEX D - RURAL PHONE NETWORK (RPN) PILOT, NIGERIA

Introduction

The Rural Phone Network(RPN) pilot project brings together the *resale of wireless air-time for public access* and *micro-finance* to establish a network of village public telephones to extend the reach and impact of GSM mobile networks in both 'near rural' and 'deep rural' localities of Nigeria. The latter refers to localities that lie beyond the normal coverage range of GSM cells but where signal reception is still possible with the use of low-cost external antennas and more sensitive user terminals. Ultimately, this pilot project will investigate the commercial feasibility and market limitations of the micro-finance linked RPN concept, as a virtual network operation similar to that of Grameen Phone.

In its study of rural Africa, Intelcon identified Nigeria as having the potential for a Grameen-like rural RPN business. This springs from several factors, including the country's high population density, the market dynamism stemming from recent liberalisation, and the fact that a micro-finance pilot (the 'Ogene' Project) involving 25 rural women has already been undertaken in Enugu state and provided some experience from which to build on. The micro-finance scheme was created by the Growing Business Foundation (BGF) in close association with the leading GSM operator, MTN Nigeria. A second further roll-out involving 25 women in Akwa Ibom state also started in June 2003. Intelcon also identified a private sector company wishing to pilot RPN concepts, utilising a fixed (desk-top) public telephone solution.

This RPN pilot project involves a third set of rural women entrepreneurs, using the two technical options (mobile handset and fixed deskset), with certain antenna and power supply enhancements that enable the pilot to investigate the commercial feasibility of the RPN concept in 'deep rural' localities. The latter refers to localities that lie beyond the normal coverage range of GSM cells but where signal reception is still possible, especially with the use of low-cost external antennas and more sensitive user terminals.

The pilot's specific issue and rural focus

The essential question to be answered by the pilot was whether it is feasible to establish a virtual RPN operator commercially in the Nigerian market, with the potential to organise and manage a large number of village based call retailers or phone shops, as in the Grameen model. The operator had expressed the view that prices are so competitive in Nigeria that, in the mainstream (largely urban) market, there is little space for an intermediary agency to develop a managed air-time resale market. Intelcon's hypothesis was that by focusing on 'deep rural' locations, where the rural phone retailer is more likely to be the only one for at least a while and where price pressure is likely to be less, the potential for both a micro-finance driven model and an intermediary to be able to develop and manage a virtual network would be greater. It was also hypothesized that the deeper rural localities are where the activity of a micro-finance agency and intermediary are most likely to have the greatest impact in terms of enabling incremental rural development by means of telecommunications.

The pilot also employed a market research firm to study every locality and potential borrower proposed by the micro-finance agency, in order to screen the application by investigating the demand, the existing competitive situation and to recommend whether the RPN business model would work in that location. The research and study methodology used principles described in Section 5 of this report.

Project organisation

Intelcon Research & Consultancy was contracted to deliver the project with the African Connection Centre for Strategic Planning as an extension to the Rural ICT Toolkit Project;



funding was thus provided by the World Bank's *infoDev* Program. The Pilot commenced in June 2003 and was to conclude 30 September 2003.

Intelecon was the project manager for the RPN, and co-ordinated and managed the involvement of three Nigerian organisations, namely:

- 1) Growing Business Foundation (GBF), micro-finance umbrella organisation responsible for preliminary identification of potential candidates, delivering four day training sessions to successful candidates, and monitoring the operators through the duration of the project;
- 2) eShekels Ltd., which was responsible for assessing the potential localities and recommending the potential candidate operators for each of the three project regions;
- 3) RM Resources, a private pay telephone distributor responsible for supplying three GSM wireless desktop units and the training and support required for them; and
- 4) MTN Nigeria, the largest mobile operator in Nigeria, and a strategic partner in the RPN pilot project providing an array of operational and marketing inputs to strengthen the commercial opportunities of the initiative.

A total of 25 women operators were trained for the pilot project, five of whom were based in rural areas around Enugu, and another ten each in the areas around Eket and Benin City. Four day training sessions were conducted in each of the three pilot areas, beginning in Enugu on 18 August, in Eket on 19 August, and in Benin on 25 August. The training sessions were led by experienced GBF facilitators who had, themselves, completed specialised MTN-designed training programs. In addition, RM Resources delivered ½ day training sessions for the three operators in Eket who were selected to use the GSM wireless desktop phones. In the first desktop village, Etebi, there had been no prior use of telephones until the introduction of the RPN desktop phone; in the other two locations the desktop units were selected to boost weak transmission signals.

The local women RPN operators were committed to the project via the terms of the GBF-managed loans which were required to obtain the handsets. The total principal for the loan is Naira 36,000, which included the cost of the mobile handset, the SIM card, an initial "Booster card"²⁹ and one N. 6,000 recharge card. GBF charges their clients 25% interest over a 10 month period, which amounts to a total of N. 9,000 for the term of the loan. An additional term insurance fee of N. 5,000 is added to the cost to protect the women against any loss or damage that might occur to the devices. An initial two month grace period leaves ten months for the full payment of N. 50,000 (USD 357) to be made, thus requiring monthly instalments of N. 5,000 to be paid to GBF. Added to this monthly total is the cost of the MTN Booster Card, which costs N. 4,000³⁰. Thus, the total monthly fixed cost of the phone is N. 9,000 before the cost of the recharge cards.

Intelecon and GBF prepared a series of calculations for the RPN operators, intended to identify the volume of minutes that each operator must sell every day in order to break even on their monthly phone operations. Those operators selling airtime at N. 30 per minute must average 69 minutes per day to break even each month, while those selling at N. 35 per minute must average 35 minutes per day, and those selling at N. 40 per minute must average 23 minutes per day.

The following data was to be collected by GBF from the operators on a weekly basis for the duration of the project:

- Total number of calls;
- Total minutes, incoming calls and total revenue;
- Total minutes, outgoing calls and total revenue; and

²⁹ MTN's 'Booster card' enables the entrepreneur to obtain per-minute pre-pay tariff rates 50% discounted for the full rate. The purchaser needs to buy one card monthly, at a cost of 4,000 Naira.

³⁰ The Booster card provides its holder with 50% discount on pre-pay airtime charges which are N. 50 per minute at the full rate, thus allowing the owner to resell airtime at a discount (e.g. at 25-35% discount from the full rates) while making a profit.



- Total number of text messages and total revenue

Initial Results

The initial results of the project indicate that, while there are a number of rural and deep rural operators in the RPN, only two are charging N. 40 per minute. At the end of the second week of monitoring, one operator reported daily sales figures slightly over the 23 minute per day break-even point, while the other averaged three to four times higher than the daily break-even point.

Fifteen of the 25 women operators are charging N. 35 per minute for airtime. Of this group, the three operators in Enugu have daily airtime averages which are within six minutes of the break-even point within the first two weeks. In Eket, however, preliminary data indicates a less positive situation, as all four operators are generating only 40% of the business they need to break even. Their colleagues in Benin appear to be little better off, as they face the challenge of having to nearly double their current levels of business if they are to begin coming close to breaking even.

Of the three price point categories in the RPN pilot, those in the N. 30 per minute category will have the biggest challenges ahead of them because of the competitive markets in which they are operating. The one operator charging N. 30 in Enugu, for example, only requires an additional 10-12 minutes per day to break even, and is the closest of all her N. 30 counterparts to making her business profitable. The operators in Eket and Benin, however, each need an average of 50 additional minutes of telephone business every day just to break even.

Of all the RPN pilot regions, Enugu currently has the largest number of operators who are either breaking even or close to breaking even, followed by Eket; Benin data received thus far from GBF was incomplete. Interestingly enough, the Intelcon consultants spent a significant amount of time and energy with the local staff in Enugu to ensure that the locations chosen for the project were more rural and deep rural, as opposed to urban-based.

Recommendations

- **Maintain the RPN focus on rural and deep rural operators**
Unlike the urban and peri-urban areas of Nigeria, rural and deep rural locations offer the potential for higher individual profits and greater levels of unmet demand.
- **Assist RPN operators in establishing support networks**
Future phases of this project should record the lessons and stories of the RPN operators so that future operators can benefit from their knowledge.
- **Provide business incentives to the RPN Operators**
MTN and the relevant micro-finance organisations should work together to ensure that the RPN candidates have more opportunities than barriers in their rural telephone operations, including reducing the current RPN fixed tariff of N. 25 by N. 1-2, providing discounts 6-8% on recharge cards and booster cards.
- **Ensure telephone service support is available in pilot areas**
Distribution channels co-ordinated through the local micro-finance organisation would greatly assist the operators to gain access to support products such as recharge cards.
- **Ensure long-term program monitoring of the RPN**
A minimum 12-month monitoring period is recommended for the RPN pilot project in order to obtain rich levels of both qualitative and quantitative information.



- **Continued use of the GSM Wireless Desktop Phones**

The desktop payphones provide a greater range of operation and management options to the rural user. The higher relative cost of the units is an issue for their continued role in the project; discussions with other payphone distributors should be initiated to identify the most viable route forward for the RPN.

- **Review training outputs and make necessary improvements**

The outputs of the three training programs should be assessed in order to incorporate the lessons learned from Phase One into those phases that follow.

- **Work with partners that have connections to the pilot communities**

Institutions that have a history with or presence in the pilot communities often bring with them a level of respect and trust that outside organisations do not, as well as requiring less resources and logistical problems to undertake training and monitoring components.

- **Encourage and facilitate diversification of operator services**

In the future, the project should emphasise the opportunities available to the women if they diversify the products and services they choose to offer. Future phases should also consider whether additional support can be provided to those who are interested in being more than just operators.

- **Continue to develop partnership opportunities with private sector partners**

The potential roles for MTN as well as other private sector partners, such as other telecommunication operators, beverage companies, oil and mining companies, etc. should be examined for future RPN initiatives.

- **Identify an overall RPN Manager**

A strong and competent partner organisation must be identified that can manage the day to day activities of the existing RPN, as well as take a lead role in future project expansions throughout the country. Ideally, a national micro-finance organisation that not only understands the commercial opportunities that exist in the rural and deep rural regions of the country, but that also has the community linkages in place in the RPN localities would make a strong fit. The project has yet to see this combination of skills and organisational scope within the current set of RPN partners, but it is expected that through the project's continued evolution, the candidates for such a managerial role will rise to the fore.

Conclusion

The RPN pilot project in Nigeria is in the early stages of demonstrating the potential for rural and deep rural networks of telephone operators to capitalise on the unmet demand for telephone services and create commercially viable payphone operations, while at the same time extending the reach, brand and revenue generating opportunities of the country's major telecom companies. Discussions are now underway with MTN to extend the scope of the current RPN pilot to the even less developed northern regions of Nigeria. It is hoped that, through the results of the current RPN pilot project, MTN's future commitment to the initiative will include real contributions that can bring significant changes to the rural landscape of the country. These contributions include recognising the RPN operators on the same level as MTN's national network of payphone operators, who are currently afforded a tariff N. 2 below that provided to the RPN project. By making the playing field more even, MTN and other telcos like it will be taking bold new steps to encourage, rather than discourage, the expansion of their networks, their brands and their services to all corners of the country.



ANNEX E - SENEGAL'S MANOBI PROJECT

Introduction

The Manobi project illustrates an approach to ICT development using existing platforms, such as the widely available GSM network, to provide useful information services. This is proposed to be appropriate for many situations in Section 6 of the African Connection document accompanying the Rural ICT Toolkit, "The Next Step: A Rural ICT Program for Africa".

Overview

The Manobi Project is operated by Manobi-Senegal, a mobile services operator and Internet-based information provider serving the rural and agro-industrial markets in Senegal. The Project is essentially a virtual network, value-added service provider which uses an existing network to provide ICT-based services to rural and coastal users.

By means of this project, fruit and vegetable producers can now use Wireless Application Protocol (WAP)-enabled mobile phones to get real-time information on the prices of their produce in urban markets. The fruit and vegetable producers, most of whom are illiterate and have never used a phone, become proficient with the Manobi system within a few days and are using the pricing information to assist in negotiations with the bana-banas, or middlemen. Previously, producers had little choice but to rely on the word of the bana-banas who visited their farms to buy their produce. The prices offered were often in the bana-bana's favour and were a frequent source of disagreement. The differences between the middlemen's prices and market prices can be significant. One farmer using Manobi's service found that he could get more than twice as much for grapefruit than the middlemen offered him. Farmers in the field can now use a mobile phone to check prices before going to the markets. The pricing information also helps the farmers determine at which market they will get the best offer for their produce.

Manobi uses teams to gather information about the prices of foods and goods being sold in the markets in and around Dakar. Manobi then uploads pricing information to its central database using mobile phones that access the server via WAP. Price collectors note the price of every food item they find. Pricing information is then transferred to and stored in a central database, analysed and transmitted to users.

Users

In 2002, Manobi tested its system in Senegal with 150 people, including farmers, importers who use the information to load their boats with the most profitable goods, and fishermen who get weather forecasts. Now that the trial is complete, Manobi has formed partnerships with organisations representing producers and middlemen.

Project sponsors

Manobi-Senegal started as a pilot project under the sponsorship of a number of organisations: International Research Development Center (IDRC) (Canada); Ceasm, a French NGO specialising in the socio-economics of the fishing and fish farming sector; Alcatel, one of the leaders in the telephone equipment market; and Sonatel, the largest mobile phone operator in Senegal. Manobi has since expanded the system roll-out as a partnership between Manobi-France and Sonatel. On January 7, 2003, Manobi-France and Sonatel, a subsidiary of France Télécom, announced the creation of Manobi-Senegal, a joint venture. Manobi-France holds 66% of the subsidiary and Sonatel the remaining 34%.

Manobi-France is both a virtual operator and provider of value added services. The company was founded by a French Senegalese team specialising in telecommunications, Internet and agro-



industrial markets. Manobi deploys its multi-modal platforms (WAP, SMS, MMS, iMode, web) and terminals (mobile telephone, PDA, PC) in developing countries and Europe in order to enable interactions through mobile networks and the Internet among professionals in the agribusiness sector. Manobi's services generate traffic for operators and new income for users. Senegal is the first African country where the system is in use.

Technology

Manobi's software and hardware platform is designed to provide low-cost services within existing telecommunications and Internet infrastructure. Part of Manobi's objective is also to encourage mobile telecom operators to extend their network coverage, particularly in rural areas.

Manobi has organised its services in the form of a virtual personal office called MyVo which is set up in the form of a user-friendly interface. MyVo is intended for clients in the agriculture and fishing sectors (producers, fishermen, fishmongers, industrialists, exporters, and importers). From any mobile or wired terminal, the user can securely access his individual virtual office to obtain a number of services, including: information on the market and on their products, communication (e.g. e-mails, news), supply information (e.g. product price-lists) and professional assistance (e.g. follow up assistance with crops).

The Multi-Channel Service Platform (MCSP) is a platform that adds multi-channel data functionality in the network of the mobile operators and requires no major changes in network structure. The MCSP was developed using open source software. In its basic form, it contains all the elements needed to access multi-channel services (web, WAP, SMS, voice). MCSP is based on telecommunication and Internet standards including SS7, ISDN, WAP, XML/XSL, SMPP, VoiceXML, HTTP, and SNMP.

The MCSP can be connected simply using ISDN or directly using SS7 signalling in configurations going from one to several thousand channels. Because of the way it is built, both possibilities can coexist on the same platform and the capacity can be quickly modified to consider new needs. The MCSP links with mobile operators' billing platforms, prepaid platforms and SMS centres.

Impact

The results of the trial in Senegal show that Manobi's system processes and compiles market information that enables both the middlemen and producers to target their markets and choose their products. The accurate information provided by Manobi is accepted as a point of reference that both parties can trust – a service that is not available elsewhere. Consequently, relations between the producers and middlemen have improved. Their exchanges have become more productive and both parties now consider themselves members of a community with the same interests. The producers' net incomes, after deducting Manobi's service fees, have increased significantly, as have the earnings of the middlemen, who are now better able to identify and take advantage of market opportunities. Finally, the markets are better supplied and the producers have reduced the risks of losses or unsold produce.

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ANNEX F - REGIONAL INTERNET POPS IN UGANDA

Introduction

Section 4 (Guidelines for identifying & developing ICT projects & opportunities) emphasizes that rural ICT programs and projects need to take into consideration the existing infrastructure situation, market structure and policy stage. Projects should be tailored to the available infrastructure and its most realistic 'next steps', given each country's policy plans and market players.

This Annex describes the 'next step' principle being implemented by a Universal Access Fund, which in Uganda's case is called the Rural Communications Development Fund (see Sections 2.5 and 2.6 which discuss Funds and also refer to Uganda's experience as one model for Africa).

Rural Communications Strategy

When the program of Uganda's Rural Communications Development Fund (RCDF) was designed by the Ugandan Communications Commission (UCC), a broad strategy covering both rural telephony and Internet was established. The strategy included the extension of public telephony services in rural subcounties not covered by the existing operators, and the extension of an appropriate level of Internet presence to the whole country. Regarding the Internet, it was realised that the country has a digital backbone being constructed by both the incumbent telecommunications operator, Uganda Telecom Limited (UTL), and the second national operator, MTN Uganda. The networks were planned to link virtually every regional centre (district headquarters town) into a national backbone. Even though the incumbent's wired network was not extensive outside of the district centres, and the most prevalent service being deployed by the second operator was GSM, it was realised that every base station tower is a potential hub for a broadband wireless system. Already, Internet access was being provided by leading ISPs, in conjunction with the two leading telecom operators in a few leading towns.

Regional Internet POPs and vanguard users

UCC decided that the provision of financial support from the RCDF to deploy a minimal level Internet point-of-presence (POP) – including local dial access and a broadband wireless hub - in every district centre, would be the logical 'next step' of national Internet development. This would enable any schools, intermediary agencies, local government and businesses who wished to become Internet users to get onto the net, either through low cost local dialling or by purchasing a high speed wireless terminal. It was thus decided to facilitate, first and foremost, the Internet POPs through competitive subsidy auction, rather than to focus on a multiplicity of telecentres and other user projects. With the latter, unless Internet POPs are already available, each project would require its own special Internet access plan; this would not necessarily contribute to the promotion of private sector access or the Internet market generally.

However, UCC also decided that *along with or following immediately behind* each Internet POP, at least one "vanguard institution" (e.g. a leading Internet-ready school or college) wishing to gain become a high speed user or to fulfill a specific public access niche could be supported, as well as training and regional content development. These would combine to promote the start-up of the local Internet market on a commercially sustainable basis.

Tender process

In 2002, there was an existing commercial public Internet POP in just 5 of the country's 56 district centres. The RCDF thus commenced its development program with a competitive "lowest subsidy" tender for implementation of 20 Internet POPs. This competition was won by a single provider, the incumbent UTL. A few internet cafés who were willing to provide Internet training



were also given pilot subsidy awards through a competitive tender process. In 2003, RCDF will commence a further competition to subsidize the provision of the remaining 31 district centre POPs and will also offer subsidies to “vanguard institutions” in the first seven districts.

The technical assistance for the tender design process, which is being financed by the World Bank, has estimated the level of demand to be expected, for dial-up and high speed access, at each district centre. Also, the expected capital and operating costs and has estimated and the size of subsidy contract that each Internet POP will require to attract an ISP to provide service has been estimated. The subsidy has been projected on the basis of a five year cash flow analysis and assumes a relatively conservative build up of demand. The subsidies will be offered on a “one-time” contract basis in which the recipient (an ISP) will receive a fixed amount over a one or two year period to set up and offer Internet services at the district headquarters town. After implementation in 2004, all potential Internet users, including those wishing to secure high speed wireless access who are within line-of-sight of the central radio tower at the district centre, will be able to secure service at prevailing market rates.

The expected subsidy contracts range from as low as \$15,000 in the most attractive districts to as high as \$60,000 in the most remote or sluggish markets. However, the final figures will, of course, be determined competitively on a district by district basis.

In order to ensure that no single ISP is able to capture the whole country market through subsidy, no bidder will be entitled to win more than 10 sites, thus after a bidder is awarded the “top ten” districts for which his bid is the lowest subsidy requirement, the winner of some districts may not be the lowest bidder. The exact mechanism for ensuring fairness and viability is still being developed.

Outcomes

An important feature of Uganda’s Internet strategy is that by late 2004, businesses and institutions throughout the country, at least those within the district headquarters’ fixed network or within line-of-sight of the central radio tower, will be able to access the Internet. Recent study has shown that some of the first users will be small Internet cafés that spring up and offer public access. Most of these will not need subsidies and for that reason the RCDF café subsidy program will probably be curtailed, so as not to unduly favour some players over others or to unduly influence the development of the commercial market. Whereas RCDF’s early strategy will not yet guarantee Internet service to the most remote corners of the country, the distance to Internet access will be greatly reduced by the placement of the POPs in each district headquarters. Many rural users will be able to access the Internet either directly or through public Internet cafés or institutions that are close to them. They will also benefit from the network access extended to “intermediary institutions” that serve their interests.

