CENTRO MULTIMEDIA COMUNITARIO DA MANHICA

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Rádio

While cost-sharing models have achieved significant success, in countries such as Angola and Mozambique, where costs of bandwidth are egregiously high, the poor still cannot afford connectivity. **SEE PAGE 10**

The telecentre in Mozambique's Manhica District.

First Mile First Inch

Lack of access to communications and information services remains a major obstacle to the economic and social development of the rural poor throughout the world — nowhere more so than in Africa.

Sadly, technological solutions that have proved effective in developed countries are often beyond the means of remote, scattered and poverty-stricken communities. Thus in South Africa, Telkom's ambitious rollout of communications infrastructure in rural areas has all but stalled with some 850 000 lines having been disconnected.

In the face of this reality, a collaborative project known as First Mile First Inch (FMFI) is working to identify and develop models and low-cost 'shoestring' technologies that will overcome such impediments to progress. Specifically, FMFI seeks to address the needs of rural communities by implementing low-cost, affordable technolo-

FMFI in Mozambique/Angola: Meeting social needs through low-cost, innovative telecoms

Mozambique's National ICT Policy, which was approved in May 2000, calls for the provision universal access to information for all citizens in order to improve their levels and productivity in education, science and technology, health, culture, entertainment, and in other activities. In addition the policy calls for the reduction and, eventually, elimination all regional asymmetries and the differences between urban and rural areas, and between the various segments of society, as regards access to development opportunities.

To these ends, the Government has officially allocated 5% of the country's gross domestic product to telecommunications development. While, in terms of developing countries, this is a substantial commitment, with an average GDP per capita last year (2006) estimated at only US$378, this represents expenditure per person of less than US$19 a year.

Perhaps because of this, however, Mozambique's Government has been more open than those in many other African countries to the deployment of unconventional "shoestring" technologies.

Two highly successful FMFI initiatives have been spearheaded by the Mozambique Information and Communication Technology Institute. MICTI is a training and research organisation supported by the Ministry of Science &

First Mile First Inch

gies and applications for Internet access and connection to the global information society that result in high use, potential revenue and/or dramatic cost savings for institutions and end users, and expanded use of Communication Technologies (ICTs) in remote African locations.

The FMFI project is a comparative study of Information and ICTs in different low-density contexts, across different projects in a number of countries.

This is a network project funded by the IDRC, a Canadian Crown corporation that works in close collaboration with researchers from the developing world in their search for the means to build healthier, more equitable, and more prosperous societies (*http://www.idrc.ca/*). The collaborative network was coordinated by the Meraka Institute of the Council for Scientific and Industrial Research (CSIR) in South Africa and 12 project partners in Angola, Mozambique, Namibia and South Africa. As such, the project comprises an in-depth exploration of five key objectives:

• Innovative First Mile and First Inch solutions
• Changed behaviour in use of ICTs

• Cost and benefits of solutions
• Scalability and replicability of technologies
• Influence on policy and regulations.

The approach taken by FMFI is essentially to foster "bottom-up" collaboration to achieve sustainable technical innovation that is scalable and replicable.

First Mile refers to the links between the access devices and the local access providers, and involved such connectivity technologies wireless (WiFi), wired Ethernet, powerline technologies, Bluetooth, narrowband HF/VHF/UHF, and mesh networks employing any of these technologies.

First Inch refers to the applications and access devices (PCs, thin clients, handheld Personal Digital Assistants (PDAs) and cellular devices). Importantly, this component of the project addresses the fact that it is often not enough simply to place technology in the hands of users; instead, the technology must be adapted to the local environment. Further, the users require training and education on the technologies.

Among the barriers to development of innovative solutions are that:

• First Mile technologies are frequently cutting edge and not yet

supported by telcos that remain committed to older technologies servicing mass markets (a major reason why their existing business models have not worked for the rural poor); and
• Many countries have telecommunications policies that inhibit the use of First Mile technologies and require licensing.

As regulatory policy should support community development, not hinder it, the successful implementation of First Mile technologies that demonstrate real benefits the poor can influence governments in the development of regulatory policy.

Importantly, the challenges are not merely technological, but social and cultural. Success therefore depends on addressing all of these issues and in order to do this the project has adopted an Outcomes Mapping methodology, which focuses on changes in the behaviour of people, groups, and organisations involved with the programme.

As President Thabo Mbeki said at the launch of the National Research and Development Strategy in January 2002: "We have to ensure that as many of our people as possible master modern technologies and integrate them in their social activities including education, delivery of services and economic activity."

The First Mile First Inch (FMFI) project is a paradigm shift from the traditional "last mile" and "last inch" thinking representing a more bottom-up grassroots approach to innovation and focusing on the end user.
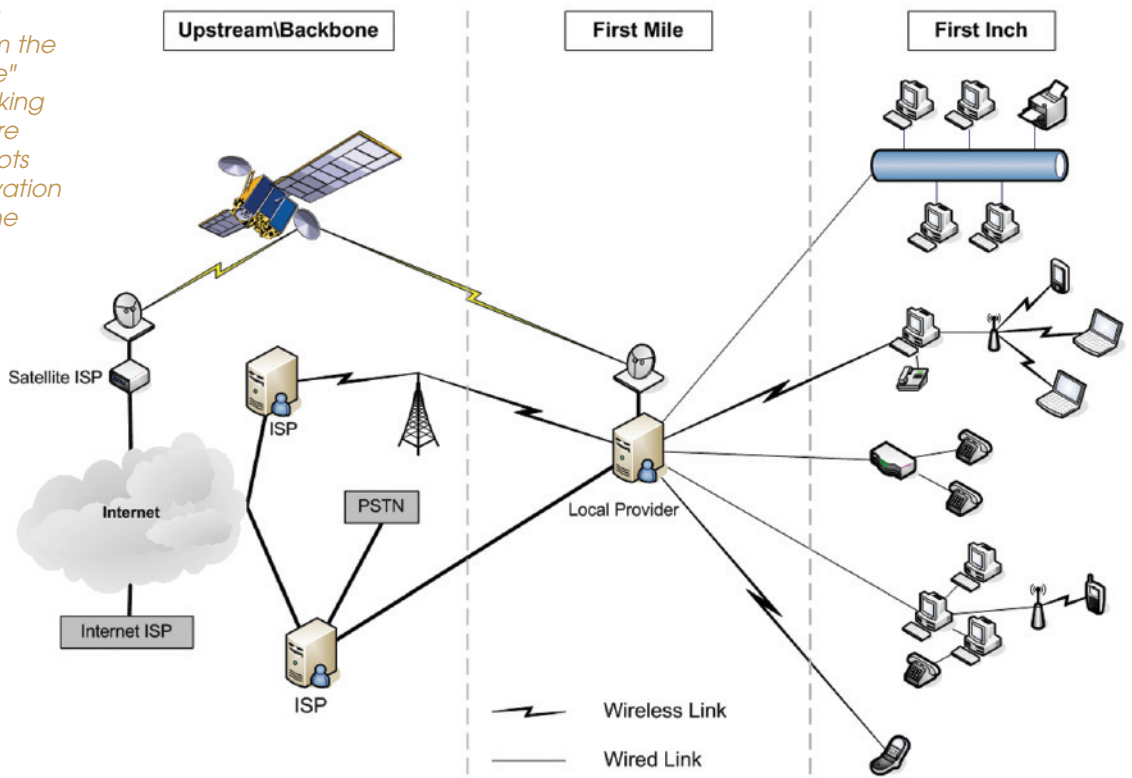
Two of the technical students assembling cantennas.

Technology and the University EduardoMondlane Informatics Centre (CIUEM). The initiatives involve:

• Production of cantennas at the Industrial Institute of Maputo (IIM):
• Telecentre test sites for operational issues.

Industrial Institute of Maputo

Students at the IMM students learn to manufacture, configure and install cantennas, which are low-cost antennas made up of a few cheap electronic components and, typically, a large empty coffee can. The IIM is also the source for the distribution of the connectivity to institutions in its area through WiFi and cantenna links.

The project has empowered IIM teachers with skills and knowledge. MICTI provided training in the production of antennas. The teachers were then in a position to train students to understand, design, manufacture and implement the devices. The teaching staff have developed their skills to the level where new technology has been developed. Final-year students are manufacturing various types of antenna and deploying them in a range of community applications at the IIM itself, in schools, in telecentres and in other community applications. The anticipated behavioural change extended to the promotion of low-cost home-brew connectivity by IIM staff and students at conferences, in newspapers, on the local radio stations and on television.

A new dimension has been added to the deployment of cantennas where students were encouraged to explore the commercial potential of the deployment, to seek out potential customers in the government, local authority, NGO, business and private sectors to pay for the installation and use of the connectivity.

Extending ICT access through rural telecentres

Telecentres are the testing and application ground for the cantennas. To ensure the overall success of the project, MICTI has become involved in the operations of the telecentres from the perspective of a research partner for CIUEM, which is responsible for the day-to-day running of the telecentres.

The success of the first two pilot telecentres in Maputo, installed in 1999 by CIUEM supported by IDRC, has led to the establishment of six more centres, most of them in rural areas.

In each case, the telecentre links a variety or organisations such as governmental institutions, NGOs, schools, healthcare centres, banks and small- and medium scale businesses. Each telecentre provide a variety of services such as telephone, e-mail, Internet, fax, photocopying and printing. Some also offers computer training, graphical services, TV & video, and community radio.

All have leased lines. CIUEM acts as the ISP and provides e-mail services and web sites for the initiative. These sites are being positioned as community multimedia centres offering computer access, Internet and community radio services. The telecentres provide outward WiFi connectivity to schools, district administration, municipalities and health.

The main concern MICTI had at the deployment level was to provide a framework for sustainable connectivity provision through the telecentres. This involved building a relationship with the telecentre managers to identify external connectivity opportunities and potential streams of income, to be able to share the cost of the leased line installed at these sites. MICTI advocated a business model in which telecentre managers established a sufficiently broad customer base within range of the telecentres to make the connectivity provision viable as well as sustainable. The objective was to empower local institutions and individuals around the telecentres by providing access to local infrastructure and services.

Careful monitoring to the effective bandwidth at the sites enabled MICTI to proved that the telco provider, TDM, was not providing the claimed 64 kb/s. In fact, the bandwidth often dropped to 16 kb/s. After two years of argument, and joint investigations by MICTI and TDM technicians, TDM made concessions with regard to payment for actual bandwidth. This resulted in a six-month payment holiday. The current payment agreement is on the basis of actual bandwidth provided. TDM has become a willing partner, and a fruitful relationship has been established.

Massifying the use of ICTs

One of the objectives of the project, to massify the use of ICTs, was achieved through the partnership with the engineering faculty of the Eduardo Mondlane University. The faculty got students to work on the project for at least six months to gain practical knowledge of networking and VoIP telephony while helping MICTI to implement the FMFI project. An administration manual and technical literature were published in Portuguese, covering the building of cantennas and various Linux systems. These materials were used to train the new recruits to the project.

MICTI staff have participated in various events as speaker and/or exhibitor, advocating the potential of cantennas. This has helped to demonstrate MICTI's capacity to implement ICT for development projects and to build a close relationship with the regulatory authority. The team has participated in some promotional events, one exhibition organised by the Ministry of Science and Technology and a dedicated TV section at the National TV (TVM) to speak about the homebrew antennas. This was used to demystify the use of technology. With the guidelines people are able to build their own cantennas. A number of students who participated in the project have used their skills to obtain jobs with prominent ICT companies, or have started their own networking businesses.
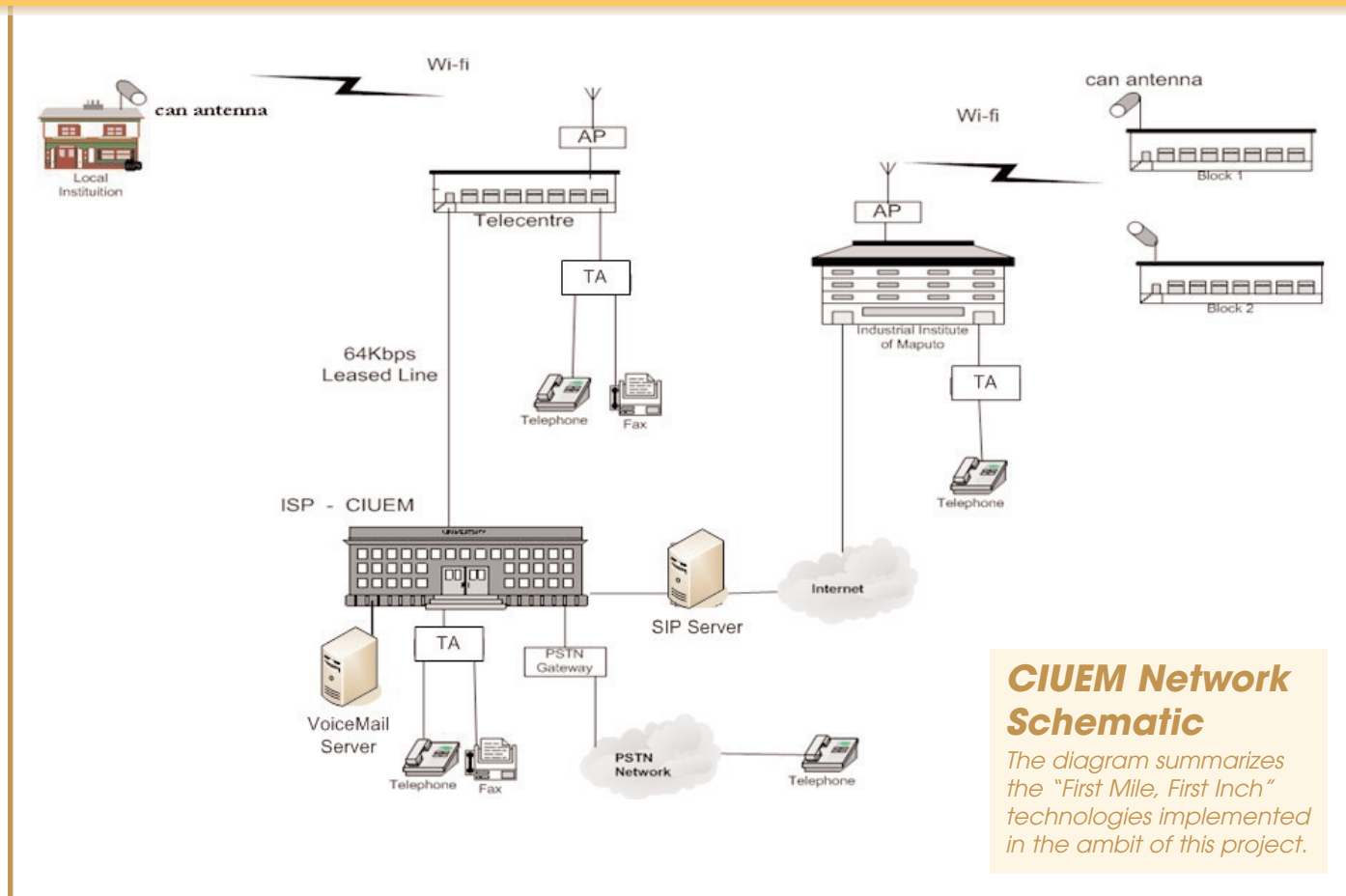
The close relationship that has developed among the telecentre staff and the community radio has resulted in dissemination of news and information obtained from the Internet to the local community. Subject matters ranges from advise on agriculture to advocacy on such issues as HIV/AIDS and malaria.

The district government has benefited from gaining access to the Internet, and has responded by providing staff to be trained and who are then assigned to the telecentre to provide technical assistance.

Challenges

An overriding challenge facing all FMFI projects is the need to influence legislators to amend and or introduce regulations that permit innovative, low-cost solutions aimed at social upliftment particularly where vested interests have failed to address the problems. A legal framework that allows telecentres to function as local ISPs and for VoIP-based applications is seen as key elements of the FMFI strategy.

Accordingly, telecentres need to be licensed to operate as ISPs. At present the project is using a free licence that is available only for research. VoIP is not licensed at

CIUEM Network Schematic

The diagram summarizes the "First Mile, First Inch" technologies implemented in the ambit of this project.

Low-cost can antenna (cantenna) made by MICTI students; installed and fully operational.

Close-up of the interior of a cantenna

all in Mozambique and a major objective of this project is to influence policy makers on this issue.

A major challenge relating specifically to telecentre operation is the problem of sustainability. A key factor in resolving this problem is getting more people using the available services; this would contribute to reducing the cost of the services to the end user. It is vital therefore to ensure that communities are aware of the benefits of using ICT resources.

The potential for Voice Messaging
To meet increasing costs, new added-value services have been identified. These include voice messaging (e.g., voice mail) that uses VoIP technologies, and the use of telecentres as small Internet service providers (ISPs) by deploying low-cost Wi-Fi technologies.

The potential of voice messaging resides in the fact that it can largely cover non-literate people (who constitutes the majority in rural areas) by allowing them to use their own local languages and without having type letters to exchange messages; real-time interaction is not required. In addition, the use of VoIP contributes to lowering operation costs.

The use of telecentres as small ISPs provides neighbouring institutions with Internet connectivity, sharing the same connection as the telecentre, which means extra financial resources, and also a contribution to disseminating ICTs in rural zones.
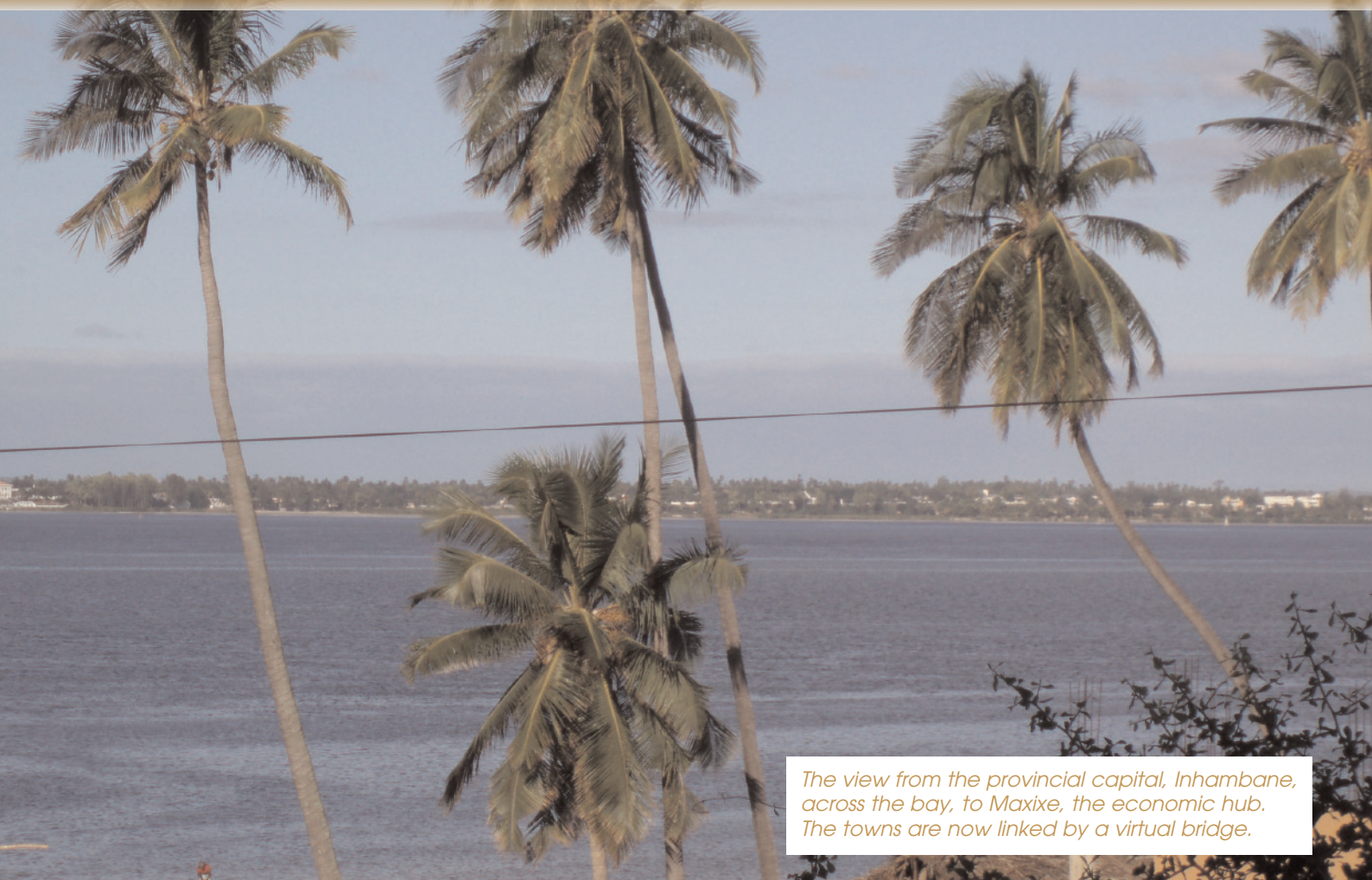
The view from the provincial capital, Inhambane, across the bay, to Maxixe, the economic hub. The towns are now linked by a virtual bridge.

Schoolnet project in Inhambane embraces wider community

An FMFI Project originally aimed at supporting one secondary school and its immediate neighbours in Inhambane, has mushroomed and now benefits a large and growing section of the community.

A decision by staff at the Emilia Duasse Secondary School in Inhambane, Southern Mozambique, 10 years ago to compete for a grant from the Acacia fund to turn a classroom into a public telecentre was only the start. The classroom-by-day and public telecentre in the afternoons and evenings gave scholars free Internet access, with paying patrons carrying the cost of the connectivity. This model of sustainability, the Governor's economic advisor has told the IDRC, has transformed the town because it "brought the Internet" to Inhambane.

Inhambane, the provincial capital, lies just 3,5 kms across the bay

from the town of Maxixe, the area's economic hub. The trip by road, however, takes 45 minutes – so it is not surprising that the Governor of Inhanbane Province dreams of building a bridge to link the towns.

In the meantime, a project team from Schoolnet Mozambique, one of the 10 FMFI research network teams funded by the IDRC and Canada Fund for Africa's Connectivity Africa programme, has built a virtual bridge across the bay. This enables the school-based telecentre to share its expensive (US$700 a month for 64kb/s) leased line with four other partnering schools and the provincial directorate of education.

The virtual bridge links Emilia Duasse with 29 de Septembro Secondary School in Maxixe. Both schools had computer networks and had been using dial-up con-

nectivity, which has created some problems: mainly limited (time) access to the Internet linked to the cost of this type connectivity and the debt incurred in the process.

The Ministry of Education recognised the difficulties and proposed an alternative configuration for the Inhambane area. The solution was to share the existing leased line at the EPCI Telecentre next to the Emilia Duasse School and to distribute the connectivity from this point to the nodes in the network through line-of-sight cantennas.

The EPCI Telecentre itself provides not only the backbone connectivity, but also is a source of skills for frontline maintenance and support for the wireless network

Importantly, the new configuration was also able to extend the network to two other schools, 3 de Feveireiro Secondary School and

the De Meule Secondary School, both in Inhambane, and the Provincial Government Headquarters in Maxixe. The leased line cost in being paid by the Ministry of Education.

With The basic ICT infrastructure in place and the cost of connectivity no longer an issue for the schools, emphasis has shifted to effective use of the resources for improvement of teaching and learning. It is expected that VoIP will be provided throughout the network soon.

Emilia Duasse Secondary School: Internet connectivity has been available at the site for about four years through a telecentre linked to the school. The telecentre has provided various services – mainly Internet access, computer training and document services —both to the school and the public. The trained people at the school maintain the network and are the main source of training of other people in the region. An additional 16 workstations have been donated and will be introduced into the school, once the computer room has been refurbished. The computer network is housed in the EPCI telecentre separate from the school. It is regarded as an "outside" activity not entirely under the control of the school. Importantly, it generates an income that enables the school to draw on these resources, especially for free photocopying.

29 de Septembro Secondary School: The school had an existing computer network and had connected to the Internet through a dial-up line. While there is a baseline of previous experience present at the school and the network, the death of the previous director of the school seems to have curtailed some of the ICT operations and a new strategy has been proposed to revitalise activities.

De Meule Secondary School: As one of the new showcase Mozambican government schools it had a new computer network installed in March 2006 and connected to the ICT backbone. The school is well equipped with both the educational network and administration workstations connected to the Internet. Staff members are keen to integrate computer activities into the curriculum. There has been no formal train-ing of teachers or students to date, only orientation sessions.

De Feveireiro Secondary School: The school was identified as a best option line-of-sight location for an antenna in the network, before consideration was given to the connectivity for the school itself. The Roman Catholic owners of the school are keen to get connected, even though they have inadequate and broken equipment at present. The school ends at grade 10 and so falls outside the ambit of the Ministry of Education's current ICT focus.

Provincial Directorate: The new network connections provides connectivity to the provincial authorities for the first time. Their main emphasis is on gathering accurate data, such as student statistics. The connection to, and direct involvement of the Provincial Directorate in, the schools ICT network has many advantages which can be exploited to increase the effectiveness of management and administration. At present, however, there are no reporting channels or systems in place to make the connectivity and linkages to the schools meaningful.

Changed behaviour in the use of ICTs

Most of the original objectives of gaining government support at national and provincial level, building a core of competent teachers, and opening up Internet access to students have been achieved. The emphasis on behavioural change has therefore shifted to the expand-ed use of the resource, and dealing with the key issues of capacity building, content creation, and school administration.

The demand for initial and further training from both teachers and students indicates that potential exists to move into the area of improving both teaching and learning using ICTs.

The current administration system gathers only global statistics from individual student records at school level. This system can be improved by putting systems in place to create a database of individual records that can be consolidated into overall statistics, while maintaining the ability to scrutinise individual records.

A major development is a recent commitment by the Ministry of Education to implement ICTs in schools, including Internet access.

The Provincial Directorate at Maxixe is a major beneficiary of the low-cost, "shoestring" FMFI Project network.

Network diagram superimposed on a satellite photo of the Inhambane-Maxixe area.

Catholic University at Pemba seeks innovative ICT solution to boost schools, shorten distance learning

The FMFI project in Pemba, capital of Cabo Delgado province, is managed by the Catholic University of Mozambique (UCM), a private university funded by the Roman Catholic Church, offers four-year degree programmes, and has more than 300 students on campus and many part-time students who have to travel as much as 200km for contact sessions with lecturers.

Prior to the project, UCM had used a USAID VSAT connection located at Pemba Beach Hotel. This was discontinued in early February 2006 as UCM could no longer afford the US$5000 monthly satellite fee. Susequently a VSAT terminal was installed at the university and connected to a French provider at a cost of US$750 ar month. It has an uplink 256kb/s and 1Mb/s down. To limit costs, the shared bandwidth option was used, but this tends to slow down traffic for most of the day, that is from 11h00 to 22h00, when there are other users on line.

UCM has a wired Ethernet network, two laboratories, desktop workstations and laptop computers. One server is dedicated to Microsoft and is linked to an outward wireless connection Pemba Secondary School and Pemba Vocational School. Although the schools are within the range of cantennas, a commercial option was chosen. There is potential to expand the network and the cantenna option will be considered for connections to NGOs and other users.

The idea is to register the project as an ISP and to expand the network to connect local organisations through WiFi links and, in that way, to share the costs of the connectivity. This will involve further consideration of the bandwidth problem and strategies when more users come on line.   The options considered here are leased-line and fibre-optic links, as well as power-line communication.

The connectivity concept will be extended, with the possibility of positioning one satellite, one ISP, one domain and a single channel for all the UCM campuses.

The main challenges of UCM in Pemba are to provide users — community members and organisations as well as educators and students — with effective ICT resources. At the same time, UCM wants to engage in enhancing teaching and learning through:

• Content creation and distribution;
• Reaching more students through distance education.

As such, UCM has adopted the motto: "Shortening the distance through ICTs."

Pemba Secondary School: The school has a network of eight computers shared by 3 600 students is a limitation. As part of the national SchoolNet Mozambique initiative, however, the school is a good candidate for network expansion to provide broader access. Teachers say the biggest constraint they are experiencing besides lack of access to computers, is lack of training. While all indicated they would like to have PCs, none could afford to buy one.

Pemba Vocational School: UCM currently has two workstations at the school connected to the Internet. These machines are located in the library, and intention is to build an electronic library linked to the existing one. UCM has agreed to provide teacher training for this. The school has two computer laboratories, one for the lecturers and one for the students. These are not currently connected to UCM or the Internet.   During the interview the school's director indicated that he would like connectivity to be extended to the two labs and UCM has agreed to do this.

Changed behaviour in the use of ICTs

The project created ICT awareness among the principals and teachers of the feeder schools, trained teachers in the use of ICTs, and encouraged the use of ICT tools for administration. The teachers share their knowledge with the schoolchildren so that when new students arrive at the university they are computer literate and be able to use ICT resources for research and communication.

Each teacher has the task of preparing lesson plans and notes on PowerPoint slides, which can be used in printed or electronic form. Teachers were able to find and store information, but said that they needed more training before they would be confident about creating content and using it in the classroom or disseminating it among their colleagues.

Users are actively engaged with e-mail and chat rooms, and have progressed to the point where they have tested VoIP.

To consolidate the collaboration, UCM intends to expand its institutional linkages through the creation of task force groups, focusing on content development, web site creation and dissemination of educational content created or facilitated by the university.

In the absence of paper-based content in the Mozambican education context, the approach is heavily reliant on Internet access to be able to deal with the content requirements of the problem-solving exercise. UCM has created the resources at the university and connected schools to create the foundation for this approach to work. The changes in behaviour in this arena are facilitated through direct engagement and support.

ISPU FMFI Schematic Network Diagram
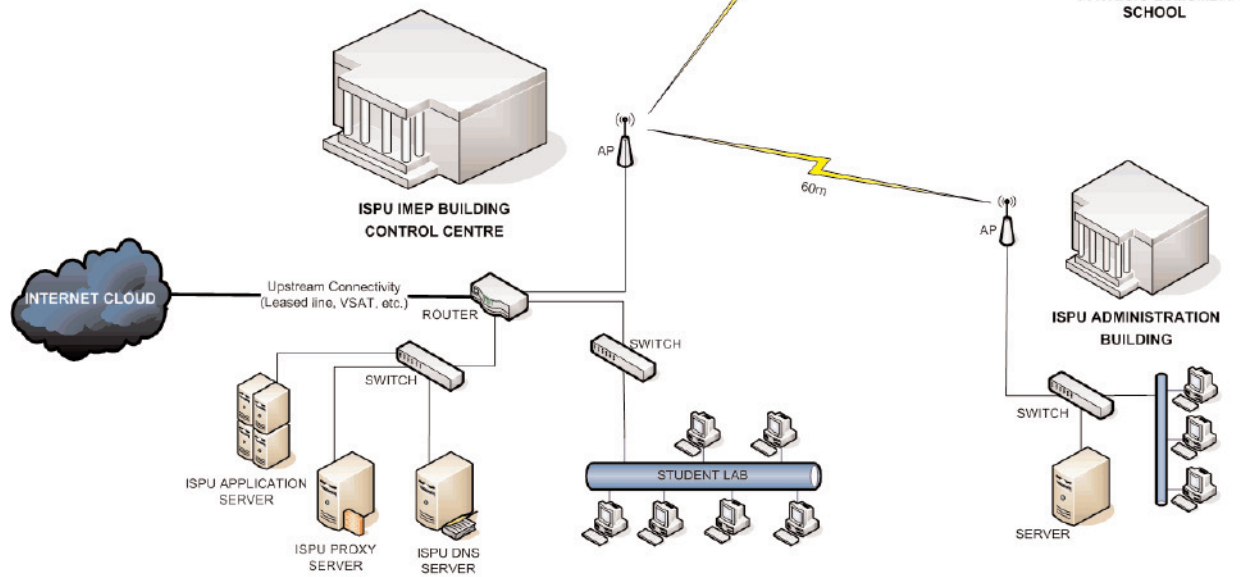
Using innovative, low-cost solutions to bridge the internal digital divide

In one of Mozambique's least developed provinces, the Instituto Superior Politécnico e Universitário (ISPU), a private university, is working to build an affordable communication system in the local community that benefits everyone who participates in it and which makes the best use of whatever resources are available.

The aim of the ISPU project in Quelimane, the capital of Mozambique's northern Zambezia Province, where the university has an extension, was interconnection with two other institutions, the Instituto Medio Politecnico, (IMEP) and Patrice Lumumba Secondary School, (ESPL).

The aim of the project was to make available an e-learning application developed at ISPU to secondary schools. The ESPL was selected in this pilot phase of the project due to its closeness to ISPU and ease of connection. Specifically, the project seeks to contribute to secondary education in such areas as science and mathematics, including HIV and sex education. Gender is of primary concern as it is recognized that uplifting the girl child will have a significant impact on development globally. Using the capacities of ICTs will help to open borders and break through the isolation experienced by students, staff, and people generally in from Zambezia.

E-learning and the use of ICTs in education depend heavily on the infrastructure established by telecoms companies that generally adhere to the "Last Mile Last Inch" philosophy. ISPU Quelimane set out to explore how First Mile First Inch technologies can be used to develop ICT skills in secondary school students, and to provide online education resource tools for its own students.

Research

The research process itself proved a challenge on its own as the researchers had been more used to computer science research meth-odology and using quantitative and qualitative research methods.

Feasibility studies were undertaken to examine economic, scheduling, social and technical aspects of the project. Return on investment (ROI) was the main technique used in economic feasibility studies, while a range of parameters were developed for scheduling in an environment where there were long- distance cycles between Queli-mane and major suppliers of the networking equipment. In addition, it was necessary to build capacity at ISPU Quelimane to develop, implement and maintain wireless technologies.

Literature reviews and Internet searches on wireless technologies and innovative wireless solutions were done to increase the technical know-how, while research on regulatory aspects of telecommunication in Mozambique was carried out to determine the appropriate choice of equipment and online services. In addition, assessments of telecentre operation throughout Mozambique were studied.

Other Challenges

Connectivity is the most expensive component of the project and, taking into account economies of scale, it can be cheaper if shared. VSAT and direct TV technologies may change these assumptions, but rural communities are typically not attractive to profit-oriented telcos, and must be self financed. It is important to remain alert to new technology developments as these

are often less expensive and more efficient than old technologies.

The most obvious obstacle to using ICTs in schools is the cost of hardware. The project covered only the networking hardware and not computers. At the start of the project Patrice Lumumba School had no computers available for students. Subsequently, 26 computers were donated. However, few of the school buildings were large enough to house enough computers for every student in every lesson. As some funding was available for renovation and rebuilding, the school library was redesigning to incorporate a computer laboratory. The project team gave suggestions on furniture, air conditioners, a white board that is dust free, and flooring material.

Project Implementation

Among numerous issues that tested the team was an initial lack of networking skills to select the most efficient and cost-effective technologies with which to implement the project.

The project team initially looked at building a network based on home-brewed solutions but, facing technical difficulties, opted for what was seen as cheaper, more sustainable solution.

Following approval of the project proposal, which underwent thorough scrutiny and revision by FMFI Project co-ordinators funds were made available and the project team contracted a Maputo-based private company, Microsis, to install WiFi equipment from Mikrotik. This equipment has worked well and demonstrated that, using inexpensive off-the-shelf equipment, a high-speed data network can connect remote areas to provide both broadband network access in locations where even dial-up does not exist. Microsis was chosen because its technical team understands the subject and had been involved in other ICT-for-education projects in Mozambique.

The wireless links operate on 5GHz (UNI band – 801.11a standard) for license-exempt technology deployment, instead of the 2.4 GHZ (ISM band – 801.11b/g standard), as it is less sensitive to interference and more channels are available. It might be argued that the team opted for an expensive solution. However, not only is 5GHz band equipment is becoming cheaper, it guarantees greater stability on the network.

As all connections are point-to-point, the project used directional antennas for better performance. Distances between the buildings are quite small, and taking advantage that the ISPU Quelimane building has line of sight to the other buildings, an Omni directional antenna was installed at ISPU, and directional antennas at IMEP and Patrice Lumumba School. The ISPU installation is configured as an access point with SSID "ispunet". On the other two routers the wireless interfaces are configured as stations accessing the ispunet access point.

Lessons Learnt

It is an absolute requirement to begin in small steps experimentally and to have a programme tested by broad practice before recommending it for others.

Unless boundary partners accept and are ready to work with the project team, the project cannot take off. Accordingly, the team carried out a social mobilisation and demand assessment using participatory rural appraisal (PRA) techniques. A bottom-up approach was used in which students and teachers assessed their own ICT needs in order to make the project more useful and effective.

Licence-free wireless technology can help Mozambique, as a developing country, to implement Internet networks very quickly. This has significant implications for accelerating the growth of information systems.

STILL THE POOR CANNOT PAY

A key concept of FMFI is to demonstrate the benefits of cost sharing. However, with the extremely high cost of bandwidth in Angola and Mozambiaue, the poor cannot afford even these reduced costs. Donor support is great for getting initiatives started, but they must eventually become self-sustaining in order to survive.

However, despite the undoubted successes of FMFI projects in Southern Africa, there are no short answers to providing universal access to ICTs, warns Professor Allison Gillwald, Director of Research ICT Africa at the Link Centre at the University of the Wiwatersrand.

This may seem counter-intuitive when, as Gillwald points out: "Throughout the world the cost of technology generally, and bandwidth in particular, is decreasing. But in much of Africa, costs have gone actually gone up."

She attributes this mainly to the existence of a monopoly incumbent supplier, which operates in the absence of competition that would serve to drive prices down.

A monopoly will argue, typically, that the markets it operates in is a special case and that the introduction of competition will have deleterious effects. There is, however, little evidence of this, says Gillwald. "British Telecom initially resisted competition, but it was competition that forced BT to become more innovative and efficient with the result that it has grown profits, even if it lost market share. There are many other examples.

"Across the continent of Africa there is insufficient capacity, ineffective monopoly regulation and inefficient allocation of resources. The solution for lies the adoption of policies that create competition for the provision for services."

Development economist Prof. Tony Seeber, formerly of Unisa, agrees that the maintenance of monopolies has a negative impact on economic growth and social development.

"Almost by definition monopolies are self-serving," he says. "Incumbents have been particularly successful in spreading fud (fear, uncertainty and doubt) by playing on the paranoia that exists over the perceived threat of neocolonialism. This has frequently led to decisions to shun business relationships and technology partnerships that could have been immensely beneficial."

AngoNet: A Viable Model for Replication

Development Workshop (DW), a non-profit organisation based in Luanda, capital of Angola, initiated the AngoNet program in 1989 with the aim of supplying ICT services to non-profit and community organisations, and individuals.

AngoNet is a programme of humanitarian action that is directed towards improving access to Internet services, education, and business development in Luanda and other regional centres. The main activities aim to ameliorate the disastrous effects of a 30-year war on the country's communications infrastructure, bringing access to Internet and technology training to those in remote regions.

It has focused its activity primarily as a service provider seeking to support community networks in Luanda and Huambo. Universal access is a central part of its objectives, and it is expanding its community access activities to the outer provinces of Angola in a sustainable manner.

Phase I has been implemented in Huambo, and offers low-cost network infrastructures and ICT services to a range of partners. As well as operating telecentre connectivity services, AngoNet is responsible for the supply and maintenance of IT services to DW in two centres in Huambo and Luanda. Costs for these services are recovered from DW. The programme is expected to roll out services to a number of locations in Luanda and other provinces.

ICT configuration
DW and AngoNet have experimented with several different options and have changed their configuration three times in three years. This is not wasteful as the redundant equipment can be used elsewhere.

Backbone connectivity in the Huambo telecentre is via VSAT with local distribution through WiFi and dial-up links. The Huambo telecentre is the hub for the distribution and serves eight wireless and 24 dial-up customers, covering government, NGOs, banks, business and educational institutions. The current cost of the satellite connection is US$2250 per month.

An attempt is being made to share the cost of the connectivity between the customers on a cost-recovery basis.

Huambo VSAT/WiFi network
AngoNet has gone through the implementation learning curve to arrive at a VSAT, WiFi and leased-line configuration that enables it to provide the broader community in rural Angola with effective and efficient ICT resources, and high-level advisory services. The innovation is in that AngoNet, as an NGO, has driven a process of development of access to ICT resources to establish a viable model for replication. The main elements of the AngoNet model are:

- The initiative was driven through a rural telecentre that progressed to a level of sophistication far beyond that seen in most telecentre initiatives.
- AngoNet serves the full range of ICT users in the community, NGO, government, academic and business environment with services that are better and more reliable than those offered by competition — the (partially free) landline provider.

AngoNet Huambo Wireless Network Diagram
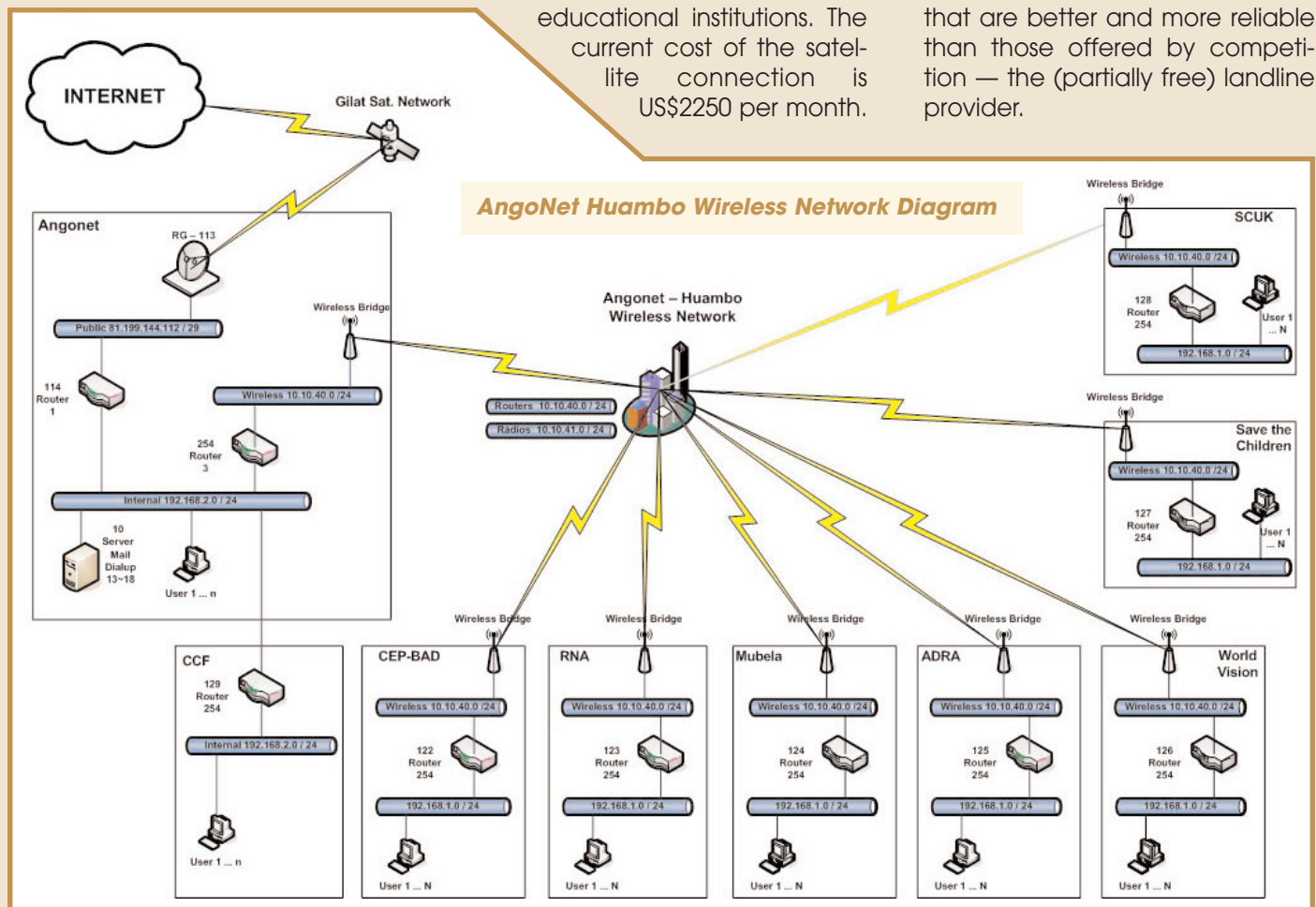
The Many Pathways to Sustainability

The current situation in Inhambane and Maxixe of a leased-line backbone sponsored by government and distributed through WiFi connectivity essentially delivers free internet to the schools and the administration. It also provides reliable connectivity options for the community through the EPCI telecentre. ICT service provision in the telecentre generates an income, some of which could be used to maintain the network. This is a business model that needs serious consideration. The integrated business model based on the lessons learned in Inhambane and Maxixe is at two levels:

- **Non-profit model:** Government sponsors the backbone connectivity for distribution to schools, administrative offices and the community. Services at the telecentre are used to maintain the network. The services are limited to the education network, delivering free Internet and support to the schools and commercial services to the community.
- **Business model:** The telecentre takes initial responsibility for distribution of the sponsored backbone connectivity and uses this foundation to expand its services to business and institutional clients, and individual users. Once the telecentre has progressed to being a sustainable commercial venture, it takes over the payment of the leased line, and charges the Department of Education for connectivity and support.

The business models for the two private universities, UCM and ISPU, are similar in that VSAT connectivity at the central university site is distributed via WiFi to target schools in the vicinity. They carried the cost of the connectivity, the distribution, training and support and need to get to a point where there is cost sharing of the backbone connectivity.

The MICTI business model involves the activity of manufacturing low-cost home-brewed connectivity equipment to build up a core of student advocates who understand the technology and can generate an income by selling and deploying the technology. This is a typical franchising model. MICTI would act as the main franchisor and assist franchisees (student entrepreneurs) to manufacture the equipment, identify customers and sites, create guidelines on pricing, assist with commissioning and provide the backbone connectivity to make it a reality. This is a supply strategy, which needs to be matched with demand. In the current Mozambican economic context there may be insufficient private demand for widespread adoption. The situation could be addressed through subsidising some of these efforts from the Universal Access Fund.

AngoNet developed a shared-cost model in which the primary cost of backbone connectivity is shared among wireless and dial-up customers. The current cost for the satellite connection is US$2250 per month which is shared among the eight wireless and 24 dial-up customers. For the 33 points served, this is an average of around US$70 per site.

Recommendations for Policy Brief

This policy brief highlights some of the critical challenges to be considered in order to achieve community access and thereby help to build an Information Society and contribute towards the Millennium Development Goals.

Although backbone connectivity was not a key research component of this project, in order to understand the First Mile it is necessary to consider the whole value chain of communications.

In all 10 of the FMFI projects undertaken in Angola, Mozambique and South Africa, cost was identified as the key barrier to community access. The cost of VSAT ranged from US$2000 a month in Angola, US$1000 pm in Mozambique to US$500 pm in South Africa. FMFI project partners had to find innovative ways to deal with these costs and create cost-sharing business models to achieve a level of sustainability.

The solution was found in sharing and distributing bandwidth to other users on a cost-recovery basis. This was done through the use of WiFi connecting the VSAT/Leased-line at the hub to other users within a 20km radius. An extension to this configuration was found particularly effective in the deployment of mesh networks. These solutions however, presented new challenges and require the following issues to be considered for policy:

- Liberalising the regulations around the use of the ISM band for social objectives;
- National ICT initiatives in education and health;
- Building partnerships with existing infrastructure owners to secure equitable access to ICT infrastructure and resources;
- Making provision for resource and cost sharing of ICT infrastructures;
- Government sponsorship of community connectivity and the potential use of Universal Access Funds in this environment;
- Implications of powerline communication (PLC) and municipal ICT networks.

To maximise the use of regulatory principles established in the FMFI context will involve escalating the regulatory debate to the Communications Regulators Association of Southern Africa (CRASA), Collaboration on International ICT Policy for East and Southern Africa (CIPESA) and the African Communication Regulation Authorities Network (ACRAN).

For more information go to: www.fmfi.org.za