ICT – Transforming the World by Transforming Universities

ICT – Transforming the World by Transforming Universities

This booklet about connecting universities in developing countries to the Internet is mainly based on a workshop on ICT Capacity Building at Universities in Developing Countries, held in Maputo, Mozambique, April 9–10, 2002. At www.workshop-ict.uem.mz you can find presentations and other material from the workshop.

The workshop gathered representatives from universities involved in research cooperation with Sweden. As a part of this cooperation Sida has decided to support the universities in their aims to connect to the Internet, to build basic campus networks and to support ICT training. The aim is to break the isolation of universities in Low Income Countries and at least overcome physical constrictions for participation in the academic debate. Sida also strongly believes that the creation and dissemination of knowledge at universities is essential for development. ICTs provide tools that can further enhance the possibilities for universities to fulfil their roles in society. Sida both promotes that universities make strategies for how to utilize ICT in research and education, and provides funds for the basic investments needed.

The workshop presented experiences from the four years since the initiative started. Discussions were lively, both concerning problems and possibilities. David Isaksson of Global Reporting in Stockholm was commissioned by Sida to cover the discussions at the workshop and to present them in this booklet. The presentation follows more or less along the same line as at the workshop. In order to illustrate more of the participants' own experiences from ICT development in their home countries some of the participants were interviewed separately. The author is fully responsible for the editing and the views and opinions expressed here are not necessary those of Sida.

Berit Olsson
Stockholm, July 2002

Content

Views from a roof in Maputo 6
Main issues at stake—a summary 8
Overcoming the digital divide 10
- Interview with National University of Laos
- "We must master the technology"
- Mozambique as an example

Narrowing the scope on bandwidth 15
- Rwanda as an example
- Interview with University of Miguel San André in Bolivia
- Mozambique Internet Exchange

Transforming research and higher education through use of ICT 22
Forming a new administration 25
- Retaining staff

Pedagogy and training 27
- E-learning and distance learning

Making the perfect sandwich 31
- Sri Lanka—a hub in science cooperation
- The PhD program

The university within society 37
- Achieving sustainability

Printed at: Elanders Novum, Gothenburg, 2002
Production: Global Reporting Sweden AB
Graphic design: Lisa Jansson
Text and photo: David Isaksson
(photo page 11, 20, 36 by Victor Brott, page 32 by Terje Bendiksby/SCANPIX

Views from a roof in Maputo

From above, Maputo looks like a welcoming warm city. The trees are green, the ocean shines with an intense blue colour. But Maputo is also the capital of one of the world's poorest countries, a country with a GDP of only 250 USD per capita.

On the roof, a group of students from Sweden and Mozambique have gathered. Their aim is to connect six university buildings in Maputo to the university backbone—and the rest of the world.

The Open.Net concept has been developed by The Royal Institute of Technology (KTH) in Stockholm. The concept can be described as an access network with a freedom of choice of service operators.

In Mozambique, few students can afford their own computer and they only have access to computers and the Internet at the university during school hours. This means that it is very difficult to conduct research activities in the evenings when the university is closed. But thanks to the project, the students will have access to the Internet through wireless computer labs in four student residences. As the situation in Maputo is not unique, the project might well be replicated in other countries.

"This is a truly multicultural project and for us this has been a great opportunity to learn more about ICT in another, to Sweden very different country", says Qarin Hjortzberg-Nordlund, one of the Swedish students. Eneas Huguana, one of the Mozambicans in the project, is also enthusiastic:

"For me it has been a very good experience working together with the Swedish students. Here, most of our studies are theoretical with teachers lecturing. Now we have to solve real world problems and that is of course very interesting," he says.

The name of the project—Mozambique Open—is in itself also a symbol of what needs to be achieved in most of the world's developing countries. Open means opening up access to the world so that students, researchers, university teachers in Mozambique and other countries can truly become partners in a global, open community where knowledge, information and experiences are freely exchanged.

There is still a long way to go. But here, on the roof in Maputo, with the sun and the breeze from the sea, the vision does not seem totally impossible.

Maputo lookout. Björn Pehrson of KTH and Americo Muchanga of UEM share the same vision. ICT will not only transform the universities, but will also contribute in the development of countries like Mozambique.
Learn more at http://2g1319.ssvl.kth.se/~csd2002-mozambiqueopen

Main issues at stake – a summary

ICT and development is a broad subject. What presented here deals entirely with ICT in relation to universities in developing countries.

1. Access and connectivity.

- Connectivity. Internet access is paramount and in many cases a key issue for ICT development projects.
- Bandwidth. The lack of bandwidth is the prime obstacle for ICT in developing countries in general and in Sub-Saharan Africa in particular. By working together universities in developing countries could negotiate better prices for bandwidth.
- Technical constraints. Lack of infrastructure, lack of qualified man power and unreliable power supply are among the major problems.
- Access to information. For a higher quality in education and research, access to information is fundamental.

2. Human Resource Development (HRD)

- Efficient administration. ICT must be used in the universities' administration in order to guarantee transparency and a more effective use of resources.
- Capacity building. Training of professionals in the ICT field will give developing countries an important knowledge base.
- Cooperation with other universities. ICT opens up new possibilities for cooperation.

3. Local Content

- ICT in research and research on ICT. Universities in developing countries can better participate in research projects and contribute with their findings. There is also a need for a specific research on ICT in developing countries (only briefly discussed at the workshop).

4. Innovative use

- The university as incubator. By working closely with the private sector the university can play an important role for the establishment of an emerging ICT industry. This will also make it possible for the university to sell services and be more sustainable.
- The university within society. The university plays an important role in introduce ICT as a way of combating poverty and improve living conditions in the country.

5. Sustainability

- Huge investments are needed, but how could they become sustainable? What will happen the day the donors phase out their programs? Sustainability is a key issue for long-term development.

6. Gender

- ICT cannot be a male only club. If you do not get various perspectives you risk loosing valuable aspects. The gender issue must therefore be further addressed in all programs.

Overcoming the digital divide

"In Laos, ICT development is a bit behind the neighbouring countries, especially when it comes to the public sector. Things are now changing and the government is very supportive for the development of ICT.

"Many professors have computers, they might use Internet at home or they use it at Internet cafés. But in the university, only a limited group of people have access to Internet through modems. The speed is of course very slow and there are a limited number of phone lines. Internet is not used for research, just for sending e-mail. But teaching without Internet is very, very difficult.

"The next step is to implement the Internet connection. We are planning to set up a reliable Internet connection for the administrative building. There will also be a room with 20 computers.

"Before the workshop, I was not aware that bandwidth could be a problem, maybe because we are at the starting stage with a small number of users. Otherwise, our problems are similar to the ones the African countries are facing and from our colleagues we can learn a lot, how to retain trained staff for example.

"Through this workshop we have learnt many things. We could also benefit a lot from our neighbouring countries. China and Vietnam have shown a very good level in this field and from Thailand especially I believe that we can learn a lot. We have a good chance to make a very fast leap forward. In five years many things can be done."

Dr. Phonekeo Chanthamaly, National University of Laos

Asia. There is still a difference in ICT development between the Asian countries.

One third of the world's population has never made a telephone call. Even fewer have tried or used Internet and e-mail. Seventy percent of the world's poor live in rural and remote areas where access to information and communication technologies is scarce or non-existing.

In order to fight poverty, the international community has identified seven "International Development Goals" or Millennium goals that are at the heart of the struggle against poverty.

Many in the donor community argue that ICT can contribute substantially to achieving these goals, either directly or indirectly. Creating digital opportunities is therefore not something that should take place once the "core" development challenges have been addressed. ICT in developing countries is a key component in the process of improving people's lives all over the world.

A lot has been written about the digital divide and how developing countries could leapfrog earlier stage of technology. Those advocating this point to how e-learning, Telemedicine, and Multipurpose Community Telecentres (MCT) help connect those living in remote areas to the rest of the world. Through this, it could be possible to at least partly close the global access and communication gap.

But to achieve this vision, huge investments in infrastructure are needed to increase bandwidth. The tele-density is still below 1 line for 100 habitants in many African countries. In Mali, for example, the tele-density is just 0.35 lines per 100 habitants (2000). The African average was the same year 2.48 lines per 100 habitants. Developing countries are not only often sidestepped in the technological revolution that is now taking place. Their citizens are often paying much more for services such as long-distance telephone calls and Internet connection than people in developed countries.

But there are also positive signs. In Africa, the number of mobile phone users was 1.98 per 100 habitants by year 2000. This means that there will soon be more mobile users than fixed line users in Africa, an example of how Africa can leapfrog earlier stages of development.

Another problem is language. Most of the information exchanged over global networks such as the Internet is in English, the language of less than ten percent of the world's population. There is very little local content software based on cultural legacy. This clearly puts many people in developing countries at a disadvantage despite projects being carried out to develop customised versions of software suited to developing countries and to develop simpler and cheaper computers (the Simputer is already under production in India).

Progress also depends on telecommunication reforms that have not yet been implemented in many countries. Here, state monopolies, rampant corruption, lack of democracy and low transparency present major obstacles for bridging the digital divide.

With so many challenges—and opportunities—it is no surprise that the digital divide has become a popular theme. There are literally hundreds of web pages dedicated to the theme. UN agencies, the World Bank, donor agencies, NGOs and several others are dedicating a lot of time and effort to the issue, sometimes cooperating, sometimes competing for resources.

The Digital Opportunity Task Force (DOT Force), created by the G8 Heads of State at their Kyushu-Okinawa Summit in July 2000, brought together forty-three teams from government, the private sector, non-profit organisations, and international organisations, representing both developed and developing countries, in a cooperative effort to identify ways in which the digital revolution can benefit all the world's people.

The United Nations ICT Task Force has been set up by Secretary General Kofi Annan to find new, innovative and quick-

acting means to spread the benefits of the digital revolution and avert the prospect of a two-tied world information society.

In its composition, the Task Force represents the public and private sectors, civil society and the scientific community, and leaders of the developing and transition economies as well as the most technologically advanced.

"We must master the technology"

Access is a prerequisite for being able to participate in the new, globalised world. But is it enough just to be online? Ultimately, development is a question of knowledge and about who sets the agenda. As Venancio Massingue, Vice Rector of UEM, Mozambique puts it:

"We have to use the technology, but are we managing the technology or just deploying it? If you want to buy 20 PCs in an African country you just place an order and you receive them the next week. But if you want to know, and develop knowledge on information technology services management, you need several years.

"The knowledge for effective use and exploitation of ICT is not transferred at the same speed as the technology itself. It is therefore not enough for developing countries to implement technology, they must also master it. In achieving this we need to cooperate because this is not a one university problem, not a one continent problem. What we need to do is to find ways to speed up the deployment of knowledge, or better, to develop knowledge. We need to develop knowledge in such a way that you can have a balance between knowledge and the demand for available technology".

Bridging the digital divide
Mozambique as an example

- Convergence of computers, telecommunications and traditional media.
- Double tele-density to two lines per 100 people by 2015, with an adequate level of access for households.
- Lower the costs and improve reliability of services.
- Achieve e-readiness.
- Develop and produce a pool of ICT-proficient youth and students from which the country can draw ICT engineers, programmers and software developers.
- Develop local-content software, based especially on cultural legacy.
- Develop rural telecentres.

From a presentation by Firmino Mucavele, Faculty of Agronomy, UEM

Narrowing the scope on bandwidth

Expensive, narrow bandwidth, not correctly utilised, extensive government regulations, few users. The obstacles for ICT development in the poorer countries are so many that they form a vicious circle. And it all boils down to one thing: Bandwidth.

Since 2000, each of the 49 Least Developed Countries (LDCs), have had a direct connection to the global Internet. However, the number of Internet users in those countries remains extremely modest. While accounting for nearly ten per cent of the world's population, the LDCs account for only about 0.16 per cent of Internet users. There are more Internet users in New

Zealand than in the 49 LDCs, and, despite having only 0.06 percent as many people, Luxembourg has more international Internet bandwidth than the whole of Africa.

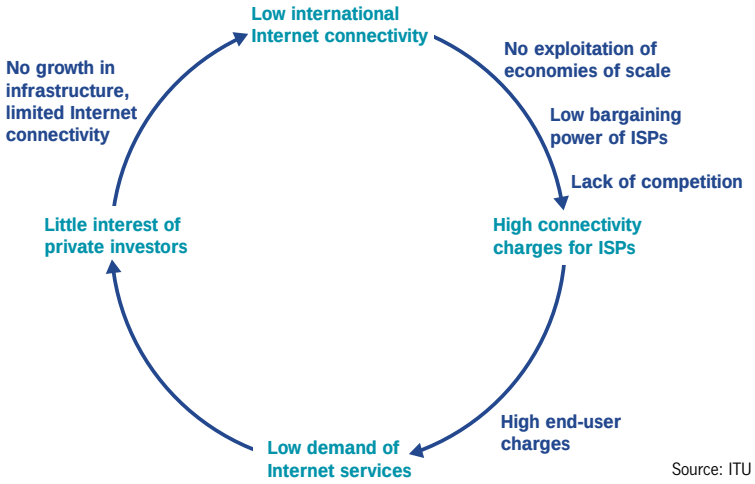
The slow growth in the LDC countries is also alarming. According to ITU, the growth of IP connectivity in Africa between 1999 and 2001 was actually below that of the rest of the world, suggesting that the digital divide might be widening.

Laos could be a good example of this. When the cooperation with Sida started, the university (which is some kilometres outside of the city center) only had three telephone lines. In order to make further contacts possible the first task was therefore to establish a way to communicate via existing ISP. The problem will be solved through cooperation with another organization receiving support from Sweden (Sida). The first step will be to set up a connection, most likely with a micro link between the organization and the university, thus ensuring that contact was established. With this in place, it will be possible to go on with the discussion on the project itself, on how to introduce ICT in the research, education and administration at the university.

The lack of infrastructure, unfavorable regulatory environment, low connectivity and high pricing and uncompetitive market structure together form what the International Telecommunication Union (ITU) calls a "vicious circle" (*see illustration*).

This vicious circle is very evident in Africa (most notably in eastern Africa), the only continent not connected with a submarine cable. Cables have been proposed for the coastline of Africa, but only a few countries are currently connected and the future development of this network is still uncertain.

The cost involved in the development of a telecommunication infrastructure and network, which is essential for the deployment of communication services, is high. Furthermore, private investors are not always motivated to invest in the least developed



Source: ITU

countries owing to the lack of market prospects and the high cost of building infrastructures.

The question is how to break this circle or replace it with what ITU calls a "virtues circle". Market forces alone will not stimulate and develop competitive telecommunication infrastructures. For these reasons, argues ITU, the international community should intervene in the field by providing funds to LDCs to develop a wider Internet network.

According to ITU, one way could be through the utilisation of flexible, simple and less expensive technology, such as VSATs, satellite links already playing a growing role in the provision of telephony, distance education and data services in remote and rural areas.

In many developing countries the Internet connection is already made through a satellite link. There is no preferential pricing for access to satellite communications for poor developing countries. On the contrary, due to low purchase power, few users etc the poor countries are paying more than others for the access.

Telecentres, like this one in Manhiça Mozambique, could play an important role in bridging the digital divide.

The lack of agreements between ISPs for data exchange between their respective networks ("peering") also worsens the situation.

One possibility, discussed at the workshop, was that universities in African countries should join hands to negotiate better prices on Internet connection, possibly in cooperation with donor agencies. This is something that will be further discussed in the groups now being formed between representatives from different universities. New players such as power supply companies could also play an important role as bandwidth suppliers. This might be a solution for some of South Africa's neighboring countries where the SA fibre optic grid stops not far from the border.

But how much are the developing countries themselves actually to blame for this vicious circle? State monopoly and the limited level of competition are definitely important factors behind the vicious circle. The VSAT links, as an example, often become expensive, as they often have to be bought through the state monopoly company for telecommunication. In undemocratic countries or countries where human rights abuses and/or corruption are common, the reason for government monopoly is often control over information and the possibility for the ruling elite to enrich itself. Whatever the reason, the pricing model of international connection restrains development, thus making it difficult for a national ICT industry to grow. There is therefore a need for convergence between ICT and telecom and also between ICT and human rights—between ICT and democracy, transparency and accountability.

Technical constraints
Rwanda as an example

- Low bandwidth.
- Lack of trained technicians and ICT experts.
- Power shortage to secure the Campus Area Network.
- Lack of computer labs, servers and remote labs connectivity using fibre optic.
- Lack of localities to host ICT support services.

"ICT technology has recently started to be used in Bolivia. Computers have been used for a few years and there are only 4 computers per 1,000 people. The existing networks are all small and developed for commercial use. So far most university teachers have used Internet cafés to get access to Internet. Some also have connections in their homes, but they are few.

"We want to establish a connection with the world so that the university could be able to contribute with what we have

achieved. What we would like to do is to create a universal system for the University of Miguel San André where we have 60,000 students and 2,000 teachers. Today we have a partial net where some institutions have their own networks and others have nothing.

"In general there is no resistance to the new technology within the university. But there is a certain level of ignorance about what could be done and what is needed in order to make this possible. Therefore, it will take many years before we are transformed into a university where ICT is used everyday, for all activities. The technology could be used to strengthen our own culture and to promote our local languages and history. There are many ongoing investigations in prehispanic cultures and ICT will definitely play an important role in this scientific work."

Blithz Lozada, University of Miguel San André, Bolivia

ICT and empowerment. The new technology can be a powerful tool for ethnic minorities fighting for their rights. Picture from Guatemala.

Creating Mozambique Internet Exchange (Moz-IX)

In Mozambique, 25–40 percent of all Internet traffic (e-mails etc) are between two users in the country (in a country like Sweden the percentage is even higher). Despite this, all traffic between Mozambican ISPs (Internet Service Providers) goes via four different VSAT satellite links to the US and back.

The aim of the Moz-IX project is to create an Internet exchange (IX) so that different ISPs in Mozambique can exchange domestic traffic in Maputo without having to go through satellite links (so called peering). At present, there are about 150 IXs in the world out of which only two are in Africa. The creation of the Moz-IX would lead to substantial savings, both for the university, which is currently paying approximately 12,000 USD a month for the 512 kb Internet connection via satellite, and for private ISPs who have similar links. This would save satellite link capacity for truly international traffic and decrease the transmission time for domestic traffic, which would benefit the country as a whole. For the ISPs, the IX will give them better quality in their connections. The establishing of an IX will also create opportunities for new content providers (ISPs and others). One important aspect is that the competing ISPs must see the IX as neutral, thus not favoring any individual stakeholder.

The Moz-IX project is part of a joint cooperation between KTH in Stockholm and UEM in Maputo. The project team consisted of three students from KTH and two from UEM. Of the total four and a half months, the students spent two and a half in Sweden designing the IX and ordering equipment. The last two months was the implementation phase in Mozambique.

Besides the technical part, the students have also had to learn about—and cope with—the administrative and business side of the project as they have been in discussions with local ISPs and others. Maintenance and sustainability are also important for the project. Donors have financed the deployment but the ISP providers are expected to pay for all recurrent costs. The IX must be able to generate its own income in the future in order to provide for development and maintenance. There must also be trained technicians who can take care of the IX in the future.

Learn more at http://2g1319.ssvl.kth.se/~csd2002-mozambiqueix/

Transforming research and higher education through use of ICT

Sweden started to support development research in 1975. The support is currently administered by Sida's Department for Research Cooperation, SAREC, which is responsible for support to research and also acts as a resource in programmes of development cooperation run by other departments of Sida in which there is a focus on research.

The objective of research cooperation is to support research, which is of significance for development in developing countries. This is done by providing support to improve the capacity to run research programs of their own and by providing support to research which can contribute to the solution of important development problems.

Sida is supporting regional research networks in Africa, Latin America and Asia which focus on, for example, energy, biological diversity and biotechnology.

Sida also supports research in important areas that require special attention. Several special projects are linked to the four action programmes which guide Sida´s international development cooperation: sustainable development; poverty reduction; gender equality; and peace, democracy and human rights.

There are today many donors providing support to ICT programmes in general. Sida has established a focal point to promote the use of ICT, identifying strategic applications for the various areas of development cooperation. The focus of ICT support in research cooperation programmes is to improve higher education and research at universities.

Access to the Internet is absolutely necessary for modern research in term of access to information, data, communication and research networking. Within the framework of research cooperation, Sida is therefore systematically assisting universities and research institutions to get access to Internet. At present, the budget for ICT projects at universities in developing countries is approximately 60 MSEK a year.

The ICT projects are usually initiated by providing assistance for making an ICT policy and an ICT master plan. To increase the long-term effects of the ICT projects, technical infrastructure is just one of the focused areas. Human resource training at various levels is an essential part of these projects as well as the development of ICT-based services such as distance learning, policy and organisation development.

SAREC also hopes universities will emphasize research on ICT as there is a need to develop an ICT knowledge base in many developing countries.

Universities are important for development. In many countries they have the possibility—and capacity—to be the driving force that could spearhead the use of Internet. But they cannot play this role in isolation. In order to participate in the fight against poverty the universities must cooperate with the private sector and the society in general. The use of ICT will make their contribution even more important.

Sweden and ICT development cooperation

Sweden is one of the most advanced countries in terms of use of ICT with a wide range of experience both from the public and the private sectors. Sweden has defined ICT as a strategically important area for development cooperation. Sida supports the rapid integration of ICT in the partner countries in order to improve communication and the exchange of knowledge, both within the countries and globally. Sida will also actively participate in international collaboration regarding ICT in development cooperation and work together with other donors, organisations and companies in Sweden and developing countries.

Sida has formulated a strategy on how the organisation can promote ICT in development cooperation. Some of the conclusions are:

- Sida should integrate ICT as a natural and important part in all its cooperation programmes.
- The development cooperation has the special task to make sure that ICT is promoted for the benefit of the poor.
- Sida should seek to develop ICT in development cooperation as a strategic area for Swedish development cooperation.

SAREC supports

- Fibre optic backbones for universities.
- Gateways to Internet.
- Networks at individual faculties/institutions.
- Access points for students and teachers.
- Education and training of end users (teachers, students).
- ICT services and applications useful for universities.
- Content development (libraries, e-learning databases etc).
- Research in the field of ICT through sandwich PhD program.

Forming a new administration

Introducing ICT as a tool in all administrative areas is seen by many universities as being the first step for using ICT as a tool for education and research.

In the University of Dar es Salaam the process began with the formulation of an ICT policy plan. The aim was to provide a common vision for the adoption of ICT with regard to the university's mission. Initially, the process was concentrated on implementing ICT into the university's administration. Access to the Internet was given high priority.

In 1989–90 a computer center was established and in 1999 a dedicated computer science department was formed. The process has since then been twofold. One aim is to develop an ICT structure within the university and for the university's administration. The other aim is to introduce ICT as a tool for education and research.

Among the areas of priority were:

- A network within the university.
- A financial information system. Important to show donors, taxpayers and others that the university works in a transparent way when it comes to financing.
- A library information system.
- An academic register information system.
- A computing center building.
- Upgrade of the professional level computing center.

Despite the overwhelming needs, there was a great deal of uncertainty within the university for the implementation. The enormous changes ICT would introduce within the university and the

institutions were not always to everybody's liking. For many lecturers, ICT was something that would disrupt their old habits. For quite some time, members of faculty remained unaware and uninformed of the ongoing ICT process.

One conclusion is that more investment is needed in promoting the policy within the university. Internal level management support is crucial for the implementation of any ICT plan. If that fails, the work for those involved in the project will be very burdensome. Another experience also shared by other universities is the importance of end user training. Both students and staff need to attain at least a minimum level of computer literacy.

As the university of Dar es Salaam was a frontrunner in ICT compared to society in general, most capacities had to be developed internally. However, the second level support provided by external partners in northern universities was vital for the implementation of the ICT policy plan.

Retaining staff

One problem facing universities in most developing countries is how to keep qualified ICT staff when the private sector is able to offer higher salaries and attractive perks. In Sri Lanka, where development in university ICT education started in 1967, universities have been struggling with this issue for many years. By working closely with the private sector to develop a center of excellence, the university of Colombo established itself as a key player in ICT development in the country and became an attractive place for work and research. The experience from recent years in Sri Lanka shows that the more the country develops, the more people come back from abroad to work there. Perhaps to start their own companies and recruit ICT staff trained by the universities. In this way the brain drain actually becomes a brain gain.

Lessons learned:

- Try to identify pioneers/early adopters who can function as promoters of the project.
- Involving external consultants can be a way of changing old prejudices and deep-rooted suspicions within the university.
- Create good working conditions for the staff (schools, housing, Internet access, office facilities, reliable power supply etc).
- Build a critical mass of researchers.
- Staff retention is a problem, as universities cannot provide the same salary levels as the private sector. Here lies a clear problem with sustainability.
- Instead of training one or two people, organize workshops with people from several institutions in order to cascade and pass on knowledge.

Pedagogy and training

The introduction of ICT into universities is clearly changing the way education is conducted. Not only is it possible to work with distance learning and achieve a closer collaboration between different universities, ICT is also paving the way for a new pedagogical approach where students are expected to play a more active role than before.

The Faculty of Education at UEM in Mozambique is a newly formed faculty that has facilitated the introduction of new pedagogical methods and ideas.

The experience of Professor Ernesto Mandlate is that ICT is clearly changing the way education is conducted. Until recently the focus was on theoretical aspects with little relation to what was happening outside the university. The student was seen

merely as a reproducer of knowledge. With the introduction of ICT the student has come to play a more active role.

"Students like places with technology so ICT has given the students a lot of motivation. Our students already show a lot of ability in ICT. They go to the library and search for information etc. But there is no point teaching students ICT skills if they have to use pen and paper in the classroom," he says.

ICT also gives university teachers the role of facilitator, organizer, manager and adviser on top of the knowledge required within their domain. This, in turn, means that the professors need to acquire new skills.

Professor Björn Pehrson at KTH calls for a collaborative framework for learning. With this individualised learning model, all students might not learn the same from the same course. The Moz-IX project (se page 21) is one example of this approach.

"I am very much in favor of an Open Source approach, there is a lot of free software available in the Open Source community. One of the first laboratory exercises for the students is to build a network using their laptops. Most things can be done with cheap hardware and free software", he explains.

A collaborative approach to learning:

- The learning goal is what you test.
- Problem based learning provides motivation for learning.
- Project driven learning provides a timeline and interaction between students.
- Peer learning. Students learn more from each other than from the teacher.
- Vicarious learning. Learning from previous parts of the same course.

Gender perspective on HRD

"Unfortunately, it seems as if ICT is something for men only, but it's not. In my department I'm the only woman involved in ICT, but I don't think it's a man's discipline. I have never had a problem with discrimination myself, but that could also be related to my character. There are women in Internet cafés, but not in the same number as men. I carried out a study in two telecenters and found there were women using the facilities, but that the great majority were men.

"The most important thing to come out of this workshop is human resource development. We have to invest in human beings to achieve sustainable development and we must begin to motivate more girls to study science and technology at school. The girls gradually disappear through the education system of Mozambique, from a high number in primary school to a few that enter university.

"I'm involved in a PhD training project with support from NORAD. The criteria include a requirement for gender balance in the selection of candidates, which we managed. I think Sida should apply something similar".

Esselina Macome, UEM

E-learning and distance learning

Several universities in developing countries have taken the first steps to developing e-learning. So far it is too early to draw any conclusions from this, but the major problem with e-learning experienced by developed countries is that teachers are not willing to give up their intellectual property rights to allow the material to be freely published on the net. This has made it problematic getting enough content for the projects.

Using ICT as a tool in education

The university should:

- Promote a research culture.
- Promote the capacity of teamwork.
- Stimulate curiosity.
- Form an intellectual autonomy.

Students should be able to:

- Communicate.
- Create presentations in PowerPoint. Achieve tasks using the web and various applications, search for and manage information.
- Interact with colleagues and teachers using technology, have the ability to use technology for administrative purposes to process data.

Teachers should be able to:

- Use traditional pedagogical means.
- Use administrative software.
- Manage learning and teaching process from the web.

Making the perfect sandwich: cooperation between universities

Cooperation between universities is an essential part of the development of ICT in universities. In Sweden, The Department of Computer and Systems Sciences (DSV) coordinates ICT cooperation between universities in Sweden and several other countries. The model is called sandwich training.

The Department of Computer and Systems Sciences (DSV) is a joint department between Stockholm University and the Royal Institute of Technology (KTH). DSV is a counterpart for several Sida-funded programes aimed at undergraduate and graduate education as well as infrastructure development. These programes currently involve a number of universities in Sri Lanka, Tanzania, Vietnam, and Mozambique.

An important argument in favor of the university as the development agency's partner in ICT projects is that the investments in infrastructure could be combined with higher education and research in computer science. Such cooperation would increase opportunities for developing countries to improve their know-how of ICT issues and through this generate a knowledge base.

Sri Lanka—a hub in science cooperation

Sri Lanka, a developing country with a high literacy rate, has the potential to benefit from the current demand for personnel skilled in IT. Sri Lanka also has the possibility to provide education and training facilities for students from other countries.

Sida has supported research cooperation with Sri Lanka since 1976. With the increasing use of ICT in all areas of research, the need to build the ICT infrastructure for the local R&D Groups


Terje Bendiksby/SCANPIX

receiving Sida grants was vital. In view of this, Sida provided assistance to improve the services to researchers.

In 1998 a proposal was submitted to Sida to fund the training of ICT staff through split PhD programs together with a proposal to improve campus networks and one for an inter university network. Sida realized that these projects would benefit science research projects already funded by them. Once the project was finalized, DSV was selected as the collaborating institute.

Today, the infrastructure supported by the project provides good Internet access to staff and students of most universities.

Provision of remote lectures through Internet-based video conferencing between universities in Sri Lanka as well as with the participating Swedish universities has been tested and in use in a limited way.

Over the years, the University of Colombo in Sri Lanka has developed an intense partnership with several universities. Students from Sri Lanka are currently studying in Sweden, Japan and several other countries. Academic staff from the Universities of Colombo, Peraderniya, Ruhuna and Moratuwa are presently engaged in research through a split PhD programe with work and stay being shared between universities in Sweden and Sri Lanka. The university has been the host for students from Africa and other parts of the world.

A problem for many universities in developing countries is that they lack students and the critical mass of teachers required to start a masters program. One model could therefore be to start a joint masters program between different universities, partly as distance learning where teachers could be pooled. Eventually, such programs could mature to also cover training of PhDs.

The PhD programe

Within the PhD programe, students do their thesis at different Swedish universities. One aim of the project is to introduce researchers into networks where Swedish researchers are already participating. It is also valuable for Swedish researchers to work together with colleagues from developing countries and in that way broaden their own perspectives. The programe has clearly given some cultural injection to Sweden and the Swedish students. In the long run, the research carried out through the PhD programe will also form an important base for Swedish universities in the future.

The risk with students studying abroad is that they could remain in the new country and not return to their country of origin, and the problem with only studying in the home country is that students do not get enough exposure to what is happening in other parts of the world.

The sandwich model means that students pursue part of the studies at home and part abroad. The aim is not only to give the students global awareness, but also a base and a motivation for returning home once their studies are completed. The sandwich model is also being used by other university programes, such as those financed by the Norwegian development agency NORAD.

Conclusions:

- PhD students must get reasonable conditions when at home.
- In PhD education, a balance should be achieved between local, sandwich and abroad studies.
- PhD programes with students from developing countries are providing Swedish academic life with a vital injection.

PhD project: an example

By Benedict Amon Sekajingo (University of Dar es Salaam), "CMM for Small Tanzanian Software Organisation"

Developing reliable and usable software that is delivered on time and within the budget is a difficult challenge for many organizations, but can be overcome through a focused and sustained effort at building a process infrastructure of effective software engineering and management practices.

To help organisations facing this challenge, the Software Engineering Institute (SEI) has developed the Capability Maturity Model for Software (CMM), which has now gained wide acceptance in software process improvement.

This thesis intends to develop a model for Tanzania software organisations, which are actually small organizations. The CMM as it is, is not directly applicable for small organizations, which are the targets in this thesis. In this thesis, The CMM will be scaled down to the needs and possibilities of the small organisations with similar environments. This will be done by assessing the software activities in Tanzania, determining the priorities, and utilizing the CMM knowledge to determine which CMM roles will be appropriate.

The university within society

As the leader in ICT, universities could play an important role in the development of the society, both in cooperation with private companies and within society at large.

"The university was among the first to promote the Internet services and Internet café model, we initiated the local telephone company into the Internet business and now they are providing Internet links to many organisations, both governmental and private including small Internet cafés. When we started, the Internet was very expensive as all access was through local dial up system. We developed a wireless solution that was quickly adopted by many ISPs and Internet cafés, something that lowered the access cost for the local entrepreneur.

"The university also played a role in establishing the ICT business. The first private ISP was started by one of my staff from the medical college who teamed up with a foreign company. Others have followed. Some students have also, when they graduated, started enterprises together.

"There is a digital divide between Tanzania and the developed world, but also one within Tanzania itself. Our attempt to create public access telecentres, Internet cafés and other facilities is a way to bridge the gap".

Professor Beda Mutagahywa,
University of Dar Es Salaam, Tanzania

Society. The aim is to create public access telecentres, Internet cafés and other facilities. The universities could play an important role in the development of the society.

"During the genocide in 1994, the university lost many skilled people and today we face a lack of teachers. In 1998 we opened up the computing center at the university. Our first priority was to provide Internet access for teachers and students so that they could get complementary information for their studies.

"We are looking at ICT as an important way to improve the quality and the accessibility of education, because the human resource is one of the keys to social and economic development of Rwanda where we don't have natural resources. The first level of empowering ICT in Rwanda will be to educate people. With the use of ICT we will increase the literacy in the country by creating the telecenters especially in the rural areas, by promoting instructional technology in the existing educational institutions.

"ICT is a powerful tool in order to link Rwanda with the outside world and to facilitate the ongoing reconciliation process. We need to provide people with information and knowledge, especially in rural areas. One thing we are looking at is the development of telecenters where people can discuss and share ideas, learn from the outside on how they handled their problems, for example the reconciliation process in South Africa."

Albert Nsengiyumva, National University of Rwanda

Sweden is one of the most ICT developed countries in the world in terms of both usage and population working within the ICT sector. Swedish industry has great expertise in areas related to most aspects of connectivity, including telecommunication equipment and consultant services. Sweden also has extensive experience of the implementation and management of technology projects in distant parts of the world due to a small home market. These characteristics would make the Swedish ICT industry an important partner in the transfer of knowledge and ICT services to developing countries. The cooperation with developing countries would also benefit the private sector in Sweden, as it will provide access to new markets in developing countries and the possibility to recruit personnel with experience from university cooperation with Sweden.

In Sweden there is a tradition of close cooperation between universities and the private sector. Universities often function as incubators for commercial projects. They play an important role, not only in graduating students but also by actively participating in various projects. This cooperation is especially strong in research-intensive fields such as biotech and ICT.

Listening to universities from developing countries, one senses a certain hesitation when it comes to cooperating with the private sector. In many developing countries the public sector is the largest employer. The private sector is small, especially when it comes to companies in the ICT sector. But instead of looking for opportunities for cooperation with the private sector many institutions fear they might lose qualified staff without getting anything in return. The Sri Lanka experience shows that there is little reason for this fear. The University of Colombo has successfully cooperated with the private sector for many years.

Lessons learned in Sri Lanka:

- Freedom from government regulations is a must. Instead of worrying about possible regulations, go ahead and do things first.
- More than anything else courage is needed, together with some kind of backing up from the government. If the government sees that you are doing well they will let you continue.
- The university should be independent from vested interest (political, individual companies, political agendas of donor countries).
- Make use of the Diasporas.
- Concentrate on developing at least one center of excellence instead of distributing resources to many different institutions.

Professor Samaranayake, The University of Colombo

Achieving sustainability

To bridge the digital divide, huge investments are required in bandwidth, running cost, infrastructure, equipment and human resources along with major support from the donors. But here lies the problem with sustainability. In order to make the investment sustainable, there is a need to develop a long-term financing model for ICT at the universities. But who will pay? What will happen with salaries, software licenses, connectivity costs, and salaries to match the private market once donor programes are coming to an end?

Sustainability requires income generation and universities can actually also make money so cooperation with the private sector is of vital importance. Many universities in developing countries are selling their services to the private sector in the form of Internet services, consultancy for private companies, fees for students etc. Sida is planning to start a study that will address the issue of sustainability of ICT projects in the public sector of low income countries.

Read more

At www.sida.se (search for ICT with search engine) you will find links and more information on Sida ICT policy and ICT programes supported by Sida.

You can download this booklet as a pdf file at:
www.sida.se and at www.globalreporting.net/ictmaputo

SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
SE-105 25 Stockholm, Sweden
Tel: +46-8-698 50 00. Fax: +46-8-698 56 15
www.sida.se