Sida Evaluation 06/13

Evaluation of Sida Information and Communications Technologies Support to Universities

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Department for Evaluation and Internal Audit

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Executive Summary

For the last eight years, SAREC, Sida's Department for Research Cooperation, has supported the introduction and expansion of ICTs in universities in a dozen countries worldwide. The programme has created significant benefits, often far in excess of expectations or cost. As a result, researchers at supported universities are much more able to compete with their counterparts in developed countries, and the overall quality of education is being measurably improved.

At the same time, discussions with users readily reveal areas where these universities still lag behind their counterparts in the developed world. It is similarly apparent that despite such deficiencies, the supported universities are light-years ahead of most of their sister institutions in their own countries. This sharp division between ICT-focused universities and their less fortunate compatriots has created a new education digital divide.

Background and Objectives. SAREC has supported the strengthening of national research capacity in developing countries for 30 years. SAREC believes that a sound foundation in computers and access to the Internet has become essential for modern higher education and research. Accordingly, since 1998, SAREC has been supporting various ICT projects to build or strengthen the ICT infrastructure in the universities with which it has ongoing relationships. In the following eight years, projects have been undertaken in all twelve countries that SAREC supports. The projects were individually tailored to meet the specific needs of the countries and the universities, and thus no two projects were identical. The projects variously provided strategic and operational ICT planning, computers, computer networks, Internet access, e-mail, web services, central ICT infrastructure, technical training, user training, video conferencing, administrative computing systems, library systems and electronic journal access. In addition to ICT infrastructure, the projects provided graduate level training at the MSc and PhD level to both increase research and teaching capacity as well as improve the quality of ICT services offered in the universities.

Given that projects have been initiated in all twelve countries, and have been completed in approximately half of them, Sida has requested this external evaluation to investigate the effectiveness, relevance, impact, sustainability and efficiency of the ICT interventions and to make recommendations addressing whether further interventions are needed and if they are, what form they should take. These recommendations should be based on the experiences, both good and bad, with the original projects, and factoring in Sida's and SAREC strategic missions.

Projects Overview. The projects varied widely based on the local needs and priorities. They typically included a subset of the following:

- Constituency-based review and creation of an ICT Policy and Master Plan providing a long-term strategy and medium-term prioritized operational goals. The process typically involved other donors.
- Campus network and Internet connectivity.
- Local Area Networks and computers for use by researchers, instructors, students and administrators.
- Networks connecting multiple campuses and/or multiple universities.
- E-mail, web and other general purpose services.
- Financial/Academic Record/Human Resources Information Systems.
- Library Information Systems.

– Access to electronic journals.

– Technical staff training.

– End-users training.

– Video conferencing.

– In-country MSc program development.

– MSc and PhD training for academic and/or ICT services personnel.

All projects involved a Swedish partner responsible for working with the university. Depending on the project, the partner might act as an advisor, technical consultant, project manager or banker. Within SAREC, a country officer was responsible for each project. Until 2002, an ICT advisor within SAREC was also involved; after 2002, an ICT advisor within Sida's Department for Infrastructure and Economic Cooperation (INEC) had a more peripheral role.

Project Outcomes: With several notable exceptions, the projects have met their goals and benefits have exceeded expectations. Projects have been implemented efficiently in terms of both money and time. The ICT capabilities have greatly enhanced both education and research, and are beginning to improve administration services. Although it is too early to know with 100% certainty how sustainable these projects will be, all universities have factored sustainability into their plans.

The list of benefits being enjoyed is large, but the following will give a feel for how the projects have improved various aspects of university life:

– Researchers can now access current literature; work collaboratively with colleagues around the world; submit, edit and review journal articles, theses and conference papers; and access web-based services and databases.

– Instructors can create electronic and traditional course materials including web-based resources and e-journals; communicate with students via e-mail; use e-learning tools to manage courses and submit marks; and issue and receive assignments electronically.

– Students can use local and web course materials and resources instead of relying purely on lectures as the sole source of information and knowledge; participate in courses and programs even if not physically present on campus; and access online administrative systems for course registration and mark retrieval.

– Administrators can begin to replace archaic paper-based systems; can have some level of control over and knowledge about the areas they manage; and can be responsive to staff and students needs.

– Universities become ICT-focused, allocating internal funds to ensure sustainability.

– Society at large has the benefit of ICT-literate graduates and access to non-degree ICT courses.

Some of the greatest benefits are ones that were neither planned nor expected. Others were expected, but with far less ultimate impact. They include:

– With their new-found ICT expertise and experience, the university ICT specialists become the prime resource helping the public sector start to use ICT effectively and functioning as national ICT champions. Key university people become both leaders and advisors in advancing the effective and innovative use of technology. In some countries, they are also active in the private sector.

– The ICT policy and planning process developed during the Sida project is used as a proven model to do similar planning within government.

– The Sida investments provide infrastructure that allows other donors to fund projects built on top of the Sida base. This catalytic effect markedly increases the value of the Sida contributions.

However, not all infrastructure projects have been successful. Of the twelve initial projects, four have had significant problems. One has been cancelled; one is in a currently unknown state due to local turmoil; one is nearly complete and generating some benefits, but was not nearly as effective or as efficiently carried out as had been hoped; and one is now progressing well after being stalled for several years. There have also been some lesser problems with other, ultimately successful projects. The reasons for the troubles are varied, but the following were contributing factors in one or more of the projects:

– Project design was short-sighted and not updated as situation changed. Equipment not well specified.

– Developing country institution or individuals not well positioned to actually implement project.

– Questionable purchasing and financial practices in violation of local and Sida rules.

– Poor record-keeping and inventory control.

– Sustainability issues.

– Insufficient oversight by either Sida or Swedish partner.

– Schedule slippage due to over optimistic planning.

To date, there have been 46 students enrolled in split doctoral programs in Sweden, and one in The Netherlands. Of the 26 who started prior to 2004, 4 have been granted PhDs, 5 were granted Licentiates and withdrew from the program, 1 withdrew from the program just prior to the Licentiate, and 1 withdrew at the start of the program. The other 15 students remain in the program and most are expected to receive doctorates. Only two students have decided not to return to their home country (the one who left at the start and one of the Licentiates). Some students are completing their studies in times comparable to Swedish students, and some are taking far longer. In many cases, the students are working full time when in their home countries, which is no doubt a factor contributing to their slow progress.

Conclusions. There were a number of lessons learned from both the successes and the failures which should be understood when planning any future projects:

– Introducing ICTs into a receptive environment where there was previously little usage can have very significant benefits and impact over and above those explicitly designed into the project. And the benefits can spill out into society at large.

– Local champions and good managers can make an immense difference. Although Sida has no control over putting such people in place, when they do exist, the situation should be used advantageously.

– The engagement and the role of the Swedish partner can be crucial to the success of the project.

– Local project management skill is a key element of success, but such skill cannot be assumed to be present at the start of the project.

– The loss of formal ICT expertise within SAREC has negatively impacted the projects.

The question of future projects is a key one. There is no doubt that one of the original motivations – to provide supported researchers with ICT tools to allow them to function competitively – has generally been achieved. In addition, the university, the quality of its education, and the skills of its graduates have all improved significantly. However, there is still work to be done:

– Since each project was a unique combination of sub-projects, many of the universities are still lacking components which are considered necessary for a robust ICT-focused university. This includes functionality which was not required when ICT services were just beginning, but are needed once the university begins using ICT in mission-critical systems.

– Inter-university networking is becoming increasingly important to allow resource sharing, research collaboration and increase Internet bandwidth purchasing power.

– There is a very wide ICT-gap between those universities funded by SAREC and those who have not had such support. It is crucial for a country's development that all university graduates be ICT literate, and that students have access to modern educational tools. Researchers at these universities also need ICT tools to be competitive.

Recommendations

The following recommendations are targeted at both SAREC in its role supporting research as well as Sida with its more general poverty alleviation goals. Recommendations 4, 5 and 6, which address issues related to large numbers of institutions, would be best addressed with multi-donor joint efforts.

1. Consider follow-on projects at previously supported institutions helping to ensure that they have access to a full suite of ICT capabilities.
2. Support inter-university research and education networks and related activities at the city, country and region levels.
3. Support interventions which will ultimately lower Internet access costs.
4. Support a programme to build ICT planning capacity in post-secondary institutions
5. Support ICT infrastructure projects at research universities not previously supported by SAREC.
6. Support ICT infrastructure projects in all post-secondary institutions.
7. Ensure that SAREC has in-house ICT expertise.
8. Clarify and formalize the role of Swedish partners.
9. Continue to support the development of ICT research and teaching capacity and review the extent to which Sida-funded graduate training is required for ICT service organizations.

1. Introduction

1.1 Background

SAREC, Sida's Department for Research Cooperation, has supported the strengthening of national research capacity in developing countries for 30 years. The support has primarily been given to universities with long-term scientific cooperation in partnership with Swedish institutions. The research cooperation includes faculty-based research programmes in agriculture, medicine, social sciences and technology administered at the universities, as well as the research supporting structures.

SAREC believes that a sound foundation in computers and access to the Internet has become essential for modern higher education and research. Accordingly, since 1998, SAREC has been supporting

various ICT projects to build or strengthen the ICT infrastructure in the universities with which it has ongoing relationships. Some of the first countries where SAREC started supporting ICT projects on a larger scale were Sri Lanka, Tanzania and Uganda. In addition to providing computers, infrastructure and Internet access for its research partners, these projects also upgraded facilities for the rest of the university, variously including campus networks, central ICT services, technical staff training, user training, library information systems and online research journal access, as well as ICT policy and strategic planning support.

Moreover, SAREC has provided specific support for university ICT training programmes including scholarships for "split" or "sandwich"[1] Masters and Doctoral training in Sweden and occasionally in other countries.

In all, SAREC has supported university-based ICT endeavours in twelve countries. The following table gives the status of projects in all countries. The total investment for these projects has been in the order of 300 MSEK or 35 million US dollars.

Country	Project Start	Target Infrastructure Completion	Current Status	Investment (MSEK)[1, 2]
Bolivia	2000	2006	Nearly complete	20
Burkina Faso	2003	2008	Planning complete, infrastructure just starting	15.5
Ethiopia	2002	2006	Unclear	21
Honduras	2005	2008	Just starting	19
Laos	2003	2007	Nearly complete	10
Mozambique	2000	2003	Complete	15
Nicaragua	2001	2007	Nearly complete	21.5
Rwanda	2002	2006	Nearly complete	35
Sri Lanka	1998	2007	Nearly Complete	62
Tanzania	2000	2008	On track	23.5
Uganda	2000	2009	Second phase just starting	51.5
Vietnam	2001	2004	Cancelled	5.4

1.2 Evaluation Purpose

Formal post-project evaluations have been done of the projects in two countries and mid-project audits or reviews have been done for two other projects. Since projects have now been undertaken in all countries in which SAREC currently operates, this evaluation was commissioned to help Sida understand the results and impact of the projects as well as the need for future efforts in this direction.

The specific issues to be addressed were:

Effectiveness: To what extent has the ICT support to universities achieved its objectives at project and broader levels? What are the reasons for achievement or non-achievement of objectives?

Relevance: The extent to which the ICT projects conforms to the needs of the universities and their

[1] A "split" or "sandwich" program is one in which the student spends part of each year in Sweden, and part in their own country.

[2] The value of the Swedish Krona has varied over the period of the projects, but a rate of 7–10 SEK per US Dollar covers most of the period.

[3] Some of these figures refer to infrastructure alone and others include library support and PhD training. Nevertheless, they serve to illustrate the large range in project size.

research activities in particular, but also in training/education, administration and library functions. Is the ICT support to universities consistent with Sida policies and priorities? Is it consistent and complementary with activities supported by other donors?

Impact: What are intended and unintended, positive and negative effects of ICT support to universities? Internet connectivity, capacity, awareness, demand and policy should be discussed. Special attention should be given to effects on research, training/education, administration and library functions, including the human resources, technical and financial aspects.

Sustainability: Is the ICT support to universities sustainable with regard to capacity building and investments made in infrastructure. Are the effects of ICT capacity building, managerial and technical, satisfactory or are further capacity development needed? Have universities made available funds for operation (including cost for international connectivity), maintenance and depreciation of equipment acquired?

Efficiency: To what extent can the costs of the ICT support to universities be justified by its results? What measures have been taken during planning and implementation to ensure that resources were used efficiently?

The majority of the ICT infrastructure projects are still ongoing, and over half of the 46 students who have begun doctoral studies are still studying. Accordingly, this evaluation can only report on the results already achieved. Even though it is impossible to predict specific outcomes, based on the current results, on the interim status of partially completed projects, and on the vast ICT experiences of universities in both developed and developing countries, it is possible to attempt to forecast general outcomes and impacts on the universities and countries.

1.3 Recommendations and Lessons Learned

The overall purpose of the evaluation is to provide guidance to SAREC and Sida regarding university ICT support. This should be done not only from the narrow perspective of the original goals and objectives, but factoring in Sida's and SAREC strategic missions. Among the questions to be addressed are:

- What lessons have been learned from the university ICT projects in the twelve SAREC countries?
- If the original objectives have been fulfilled, does such support need to be continued?
- If additional support is warranted, what form should it take, and how should it be structured?
- Are there alternative models for interventions that could be more efficient or appropriate?
- Is there a need for Sida to revise its strategy on how to promote ICT support to universities?

1.4 Evaluation Method ology

The twelve SAREC university ICT projects were reviewed through a number of mechanisms. The lead evaluator, with 40 years experience with computing and communications technologies in educational environments and over 10 years experience working with developing countries, had previously performed in-depth reviews of the first phase projects in Sri Lanka and Uganda, and a brief review of the various projects in Mozambique. From 1996–2001 the lead evaluator co-managed or managed a series of workshops training over 1,000 people from 150 developing countries on how to create, run, manage and use the Internet in their countries. Most countries connecting to the Internet after 1993 did so with people trained by these workshops and their off-shoots. In 2005, the lead evaluator performed a study

on behalf of Sida investigating the linkage between ICTs and poverty alleviation[4].

The co-evaluator had over 15 years of experience with ICT in a developing country university, and in depth personal knowledge of the SAREC-supported split graduate studies program. The evaluation team performed a short review of the original projects in Tanzania. Documents related to several of the projects were reviewed, and e-mail discussions were carried on with project leaders in most countries.

In April 2006, discussions were held with the Director of SAREC, other senior SAREC staff, the country advisors/officers for most of the supported countries, representatives of the Sida Evaluation and Internal Audit unit, and the INEC ICT for Development Secretariat as well as people involved in the early days of the program.

Discussions were also held with two partners who have worked closely with Sida on the university ICT projects as well as key individuals at the Department of Computer and Systems Sciences (DSV) of the IT University[5] and SPIDER[6].

While in Tanzania, a small workshop was held with participants from five of the six countries in which initial ICT projects are complete or almost complete. Representatives of four of the countries were onsite (Mozambique, Rwanda, Tanzania and Uganda) and four people from Sri Lanka participated via video conference. The workshop was very productive, and it was an opportunity to hear about all aspects of the projects as well as discuss requirements and options for the future.

Following the submission of the draft report in June 2006, review meetings were held in Stockholm with many of the key participants.

The above notwithstanding, it must be noted that complete files detailing all of the projects were not readily available for review. The evaluators nevertheless feel confident that they have a developed a comprehensive picture of the overall programme.

1.5 Report Structure

The report consists of following sections:

- A description of the projects
- Project outcomes from a variety of perspectives
- Conclusions
- Recommendations

Within the various documents reviewed, the terms Sida, SAREC and Sida/SAREC are at times used interchangeably. Within this report, the term *SAREC* will be used to describe those activities and actions directly under the control of SAREC, while *Sida* is used when parts of Sida outside of SAREC are involved.

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[4] *ICTs for Poverty Alleviation: Basic Tool and Enabling Sector*, Sida publication SIDA4937en, http://www.sida.se/shared/jsp/download.jsp?f=SIDA4937en.pdf&a=3607 or http://www.eldis.org/fulltext/sidaictpoverty.pdf

[5] The IT University is a joint venture between Stockholm University and KTH – Royal Institute of Technology, and is located in Kista, Sweden.

[6] SPIDER – The Swedish Program for Information and Communication Technology in Developing Regions supports the formation and dissemination of knowledge and competence in the area of information and communication technologies in developing countries. SPIDER is physically situated at KTH, the Royal Institute of Technology, Stockholm but it works with a number of universities throughout Sweden. Sida is SPIDER's main sponsor.

In some countries, the ICT project involved only a single university, while in others multiple universities or other organizations were involved. For simplicity, the term *university* is used within this report to mean whatever organization or organizations were involved in each country.

2. SAREC University ICT Projects

2.1 History

SAREC has been supporting bilateral research cooperation since 1975. Starting in the early 1980s, it became obvious that direct support to researchers was not sufficient if they did not have access to reasonable research infrastructure, and most particularly, to libraries with adequate research journals. As a result, SAREC began supporting libraries helping to ensure journal access. Such access was typically far less than that enjoyed by colleagues in developed countries, but nonetheless a major improvement.

As computers became a tool used by researchers world-wide, SAREC began to fund their purchase as well, just as it would support the acquisition of appropriate laboratory equipment.

By the mid 1990's the research world was starting to change radically. Specifically:

– Computers were no longer just a tool for senior researchers or those in scientific disciplines, but were required by all researchers including graduate students.

– The Internet had spread throughout the developed world with universities and their researchers leading the entire process.

– For many researchers in developed countries, computers and the Internet were no longer just a tool, but played a critical and integral part of their research.

At the same time:

– Computers and even networks were beginning to become common in businesses, and particularly medium to large scale businesses, with some presence in the developing world.

– Universities in developing countries, when viewed as large administrative organizations, were lagging badly in their use of computers and other technologies to help run their "businesses".

– Universities in developing countries were not adequately introducing computers and the Internet to their student populations.

Combining its earlier support of library journals with the emerging computer and networking technologies, in 1996, SAREC funded a Local Area Network (LAN) at the National Science Foundation[7] in Sri Lanka with a prime objective of making scientific information on CD-ROMs available to the scientific community of Sri Lanka. Encouraged by the positive results of this project, a new chapter in Swedish assistance for the development of science and technology began in 1998 with the commencement of the first large-scale university-oriented ICT project.

The project had two major components. The first component was the enhancement of Internet connectivity into Sri Lanka and among the state-funded universities, as well as the enhancement of

[7] At that time, the NSF was the Natural Resources Energy & Science Authority – NARESA

ICT infrastructure within selected universities. The infrastructure upgrade included campus networks, computer labs and technical staff training. The second component of the project was the PhD-level training of eight staff members from four of the public universities in Sri Lanka.

Connectivity and Infrastructure: Sri Lanka was unusual in that an inter-university network was built very early, and it is still one of the few developing countries with such a network. The project connected additional universities to the network, increased bandwidth, and on a temporary basis, provided actual Internet bandwidth into the country. The infrastructure projects also attempted to bring all of the SAREC-supported universities up to roughly the same level of ICT facilities. There was a wide variation in the level of existing infrastructure among the various universities, and the project allocated resources accordingly, with the less-developed universities receiving the bulk of the infrastructure funding. In general, the infrastructure projects were not limited to researchers – the entire campus would be in a position to benefit. One aspect of the project did favour SAREC-funded research groups; in some universities, SAREC-supported research groups received a local area network and computers. The fact that the bulk of the resources could ultimately serve the entire community was a critical issue. One could argue that all graduate students and thus all researchers start out as undergraduates, so by giving ICT access to undergraduates, one is really helping research. Although this is true, a better argument would be that researchers do not exist in isolation and that if ICT is to be a substantive part of their environment, it will need to be available to all[8]. There were no explicit administrative aspects to the Sri Lanka projects.

PhD Training: The graduate level training followed the model that SAREC had found successful in other disciplines, namely the split PhD program where students spend part of their year in Sweden, and part at their home university. Although the time spent at their home university does not tend to be as productive as that spent in Sweden, there is increased probability that the student will complete the PhD program and then return home. Most universities in Sri Lanka had very few (or no) PhD-level staff members in their Computer Science and ICT departments. Moreover, only a subset of these people was actively engaged in research. At no university, perhaps except the University of Colombo, was there a core critical mass of researchers allowing ongoing research and the local training of graduate-level students. The project identified eight Sri Lankan Computer Science students who began the process of obtaining their doctorates at four Swedish universities in 1999. Of these three have been granted doctorates, three have earned their licentiate and are still working on their doctorates, one stopped at the licentiate level and one dropped out early in the program for personal reasons. Those with doctorates are back at their home university in Sri Lanka. The three studying are also expected to return. The two who left the program early are no longer in Sri Lanka.

ICT projects were begun in Tanzania, Uganda, Mozambique and Bolivia in 2000[9]. They typically involved physical infrastructure of various sorts as well as technical training. Nicaragua and Vietnam were added in 2001, with Ethiopia, Rwanda, Burkina Faso, Laos and Honduras added in 2002–2005. There were 13 doctoral students from Mozambique and Tanzania, and several more were later added from Ethiopia, Vietnam and Uganda.

All infrastructure projects involve a Swedish partner, typically a university but more recently SPIDER. The Swedish partner variously acts as an advisor and consultant, often playing a supervisory role as an agent of SAREC. In some cases, funds have been managed by the Swedish partner instead of the target university.

[8] It has been argued that there was really no choice but to open the infrastructure to the entire community, but that is not at all true. If one looks at the history of ICT technology in Western European and North American universities, researchers were the prime, and in many cases the only, users of early technologies. Few other than researchers had ready access to computers, the Internet was built for their (almost) exclusive use, and students and administrators had limited if any access to these technologies.

[9] There was also an early ICT program with Zimbabwe, but that was cancelled when Sida withdrew direct support in 2001.

2.2 Infrastructure Projects Overview

The overall purpose of the projects was to enhance the availability and usability of computing and networking. Projects were tailored to the most pressing needs of each university/country and thus the details varied considerably.

At a global level, the major thrusts of all projects included several of:

1. *Creation of a University ICT Policy and Master Plan:* As used in this context, an ICT Policy is drafted following a constituency-based review of how ICTs can and should be used within the university and it sets strategic targets. The Master Plan is a medium-term operational plan detailing what needs to be done to move towards the Policy's targets, with the goals prioritized. Other donors were invited to participate in the planning process. As a result, multiple donors have often worked cooperatively on meeting the university's goals.

2. *Provide physical ICT infrastructure for general, instructional, research and administrative uses:* Typically, this thrust involves building an intra-campus network (usually fibre-optic based, but often mixed with radio) interconnecting some or all buildings. Often basic networks within the buildings are also included. In addition to the physical transmission medium, the network includes active electronics, network management, and a number of other services necessary for networks to function. Equipment to facilitate external Internet connections has sometimes been provided, and in a few cases, the projects have paid for actual bandwidth charges for limited periods.

3. *Provide or improve computer and Internet access to researchers, students and staff, sometimes with a focus on SAREC-supported research groups:* Backbone-connected local area networks and their attached computers and printers are the major part of this component. Building networks may also be included if not already part of the campus network. Computer clusters for either teaching purposes or general purpose laboratories are common to many projects. In general, LANs for staff use within academic units have been provided only for departments with SAREC-funded researchers. Some projects included video conferencing facilities

4. *Provide or improve general networking capabilities within a multi-campus university or multi-institution consortium:* Connecting together multiple campuses of one university allows all campuses to benefit from the centrally provided services and Internet connectivity. It also allows the remote campuses to access and use central administrative systems, library resources such as journals and catalogues and to share ICT skills and knowledge. On a similar level, connecting together multiple institutions allows them to share these resources and facilitates research collaboration[10].

5. *Provide support for general purpose, administrative and teaching applications within the university:* Most projects included some component of basic universally-useable applications such as e-mail and web servers. All of the projects have allowed and supported the use of core infrastructure for administrative and teaching (e-learning, course management) applications, but a few have also provided funds to acquire and install such application systems.

6. *Train ICT staff and end-users:* Equipment is of little value without people who know how to use it. The situation is even worse with the complex systems which comprise LANs, campus and inter-campus networks, web servers, e-mail and applications systems. Without skilled technicians to run, support and maintain them, such systems quickly lose all value. Accordingly, all projects have included some level of training for core ICT staff. Some projects also make provision for end-user training. This can be in the form of train-the-trainers, packaged training material, or training facilities (labs).

[10] Without local regional networks, two researchers in neighbouring universities will generally communicate with each other via Europe or the US. A regional network allows their messages to go directly to each other, bypassing satellites and foreign connection points.

Depending on the project, "end-users" may include academic staff, administrative staff and/or students.

7. *Improve library facilities in general, and more specifically, research reference material:* Libraries were the origin of SAREC's "infrastructure" support, and they have been included in many of the ICT projects. Support has included physical infrastructure within libraries, LANs and labs for patrons, Library Management systems (including online catalogue) and of course electronic access to journals. Since such systems are a major departure from the traditional paper-based libraries, training of librarians has also been an important focus.

8. *Improve post-secondary ICT training including graduate training and ICT research capacity:* Of the twelve university ICT programs, six have students enrolled in doctoral programs in Sweden (and one in the Netherlands)[11]. The original motivation in Sri Lanka was that upon completion of their programme, these students would be able to form the basis for a self-sufficient research and teaching unit, with the ability to grant graduate degrees without external support. That is still part of the motivation, but in some of the later countries, it is clear that the students are coming from and will return to service units that do not have academic research or teaching responsibilities. In addition to the doctoral students, there have also been a few students enrolled in Masters programs with no immediate intention of proceeding further. One project has used Swedish expertise and instructors to establish an in-country MSc program which ultimately will be self-sufficient.

Although not a funded part of the projects, sustainability has always been a crucial intended outcome. The medium to long term goal has been to ensure that the infrastructure being built can be maintained and supported without donor funds. To this end, efforts have been made to involve local government offices responsible for university funding.

2.3 Swedish Partners

All projects have had a Swedish partner organization, typically a university, but in recent cases, SPIDER has played that role. The Swedish partner is typically represented by an academic member of staff from the partner university, sometimes augmented by others. The role varies from project to project, and over time. The responsibilities can include:

- Act as project advisor;
- Work with the developing country project team to design the project so that it addresses Sida and SAREC's goals as well as addresses the university needs;
- Liaise between the developing country project team and those at the partner university who can provide particular expertise (technical issues, hardware selection, education);
- Act as project manager, with a responsibility to report project status and issues to SAREC;
- Manage project funds in cases where this seems to be a better alternative than giving the funds directly to the target university (perhaps due to the complexity of the developing country purchasing practices, or perhaps to ensure proper record keeping and auditability).

In some cases, the relationship has worked out well, and in other cases less so. Certainly the initial model used for Sri Lanka with the DSV as a partner was deemed to be successful by all concerned. In that case, the two organizations worked well together, with both groups having a large amount of respect for each other. In some later cases, there were a number of perceived problems:

[11] There was a short-lived attempt to include students from one other country, but language problems proved unsurmountable.

– The developing country university did not feel that they really needed any advice or help. This is certainly true for most second projects, but for some first ones as well;

– The Swedish partner took a very "hands-off" position and did not feel they needed to get involved. Unfortunately, that scenario does not work well if the project encounters difficulties and no one tells the partner (or if the developing country people do not even realize there is a problem);

– The Swedish partner was unfamiliar with developing country environments and/or did not really know what was expected of them.

2.4 SAREC Involvement

After the first ICT projects were started, an ICT unit was formed within SAREC. The ICT projects were managed as a joint effort by the advisor/officer responsible for that country and one of the ICT advisors. By 2002, it was recognized that the ICT unit was also involved with projects outside of SAREC, and that there was a need to increase the integration of ICT into the whole of Sida. As a result, the ICT unit was moved to the Department for Infrastructure and Economic Cooperation (INEC) and became the ICT for Development Secretariat (ICT4D).

ICT4D still had an involvement with the SAREC ICT projects in conjunction with the country officer, but no longer with the same formal responsibility. This relationship worked well for any given project as long as the country officer and ICT4D person remained the same, but as people moved in and out of the groups, it was far harder for the new pairings to work as effectively as before.

The current group of country officers responsible for ICT projects are a very professional group of people who take their jobs seriously. However, most are not ICT experts, and ICT is just one of the many aspects of their responsibilities.

Looking towards the future, there is a feeling among SAREC management that perhaps SAREC should phase out university ICT projects. The rationale is simple:

– SAREC has been quite successful in "kick-starting" ICT in all of their supported universities;

– Most researchers at these universities now have reasonable access to computers and the Internet;

– It is now time for other donors whose mandate is wider than SAREC's research focus to step in.

3. Project Outcomes

The results of the projects will be reviewed from several major perspectives – the success of the projects based on their original intent, the benefits as seen by various constituencies, unexpected benefits, and problem areas. Although quite preliminary, the result of the doctoral training program will also be reviewed.

The infrastructure projects are in various stages of completion. Nine of twelve countries have projects that are active or just barely completed, although in some of these countries first phase projects are complete. Therefore, it is not possible to predict all outcomes with complete certainty. However, based on the results of the completed projects, on the interim status of partially completed projects, and on the ICT experiences of universities in both developed and developing countries, there is reason to believe that the remaining projects will show results similar to those in countries where the programs are more advanced. Of course one cannot factor in any completely unforeseen problems.

3.1 Sub-Project Results

With the exception of the problem issues to be discussed later, the projects were generally well implemented, well received and have met the original objectives. Although it is difficult to make very specific statements about efficiency, with a few exceptions, the money has been well spent – certainly in the cases of the projects reviewed in detail.

The following sections provide details on the various aspects of the projects as described in section 2.2. It must be noted that SAREC has not been the only donor funding ICT at some of these universities. In some cases, other donors provided early support prior to SAREC's, and certainly SAREC has actively encouraged other donors to support complementary activities in parallel with the projects being reviewed. Accordingly, it can sometimes be difficult to attribute direct causes and effect between the SAREC projects and the ultimate results. Nevertheless, in all cases, SAREC has funded core underlying infrastructure – either creating or augmenting it, and this infrastructure is always used as a base on which later donor's projects sit. In many cases, other donors have been more interested in funding specific applications or end-user facilities rather than core infrastructure. Accordingly, there is no doubt that SAREC projects have contributed greatly to all of the results described herein.[12]

3.1.1 Creation of a University ICT Policy and Master Plan

The planning exercises, often carried out in conjunction with a team of experts from Delft University of Technology in The Netherlands, have been considered to be successful by all parties. The process forces the university to focus on both long-term strategic goals and then short term objectives. Once the objectives are determined, they are prioritized – an important step in setting achievable targets. Since these exercises are normally carried out with involvement from the various constituencies, there is a reasonable chance that they will address real needs. Although the documents produced are of great value, experience has shown that the *process* is critical in ensuring commitment and ownership from both management and the user communities. This significantly increases the probability of success and of user satisfaction.

In some early instances, the university has updated both the policy and the plan after a number of years.

The plans have at times been too optimistic regarding how fast objectives can be met. This is particularly true for objectives which were not purely technical, but involved social/human aspects as well. End-user training and the widespread adoption of e-mail are good examples of goals that cannot simply be legislated.

The participation of other donors in the planning process has been encouraged. This has resulted in significant donor cooperation and synergy. Often the various donor interests have meshed well in this respect and that has helped ensure that all of the highest priority items have been funded.

3.1.2 Provide physical ICT infrastructure for general, instructional, research and administrative uses

Building physical infrastructure is now a well-understood discipline. Typically, this aspect of the projects has been quite successful. Where there have been problems, they are typically political in nature, or due to arcane local purchasing procedures. Physical campus infrastructure has been a part of most SAREC ICT projects, and for good reasons; having such infrastructure is a mandatory pre-requisite to other ICT developments and it is typically expensive. Like many infrastructure projects, it becomes invisible

[12] As an example, at Makerere University in Uganda, Norway has funded library infrastructure and an ICT building, the Carnegie Corporation has funded library computer labs, and the Rockefeller Foundation has funded research computer labs and together with the Ford Foundation has funded local content databases. But all rely on the existence and functionality of the SAREC-supported network infrastructure and trained staff.

once it is built – until it fails, but it is an enabler that allows all of the other services and systems to function. The success of the infrastructure is thus generally measured by how well the rest of the ICT systems work and how ubiquitous access to them is.

Actual links tend to be either fibre-optics or radio. Fibre is generally accepted as being the better long-term choice, as it is faster and definitely more reliable, but often radio is the only viable choice, particularly for long distances or links crossing non-university property.

More recent projects have also started to include Voice over IP (VoIP) capabilities which allow the core infrastructure to be used for voice telephony as well – a trend in both developed and developing countries. Although rare in basic requests, more advanced networks will now also provide file storage for users and a range of security enhancements aimed at making the network more reliable and safer to use.

3.1.3 Provide or improve computer and Internet access to researchers, students and staff, sometimes with a focus on SAREC-supported research groups

Improved access simply means that staff and students should be able to readily use a network-connected computer. The exact definitions varied by university, department, and type of user. In many cases it meant labs, but also included computers for individual academic and administrative staff. In any given university, the number of required computers far exceeds the number provided under the SAREC programme and other donors or internal funds have been used to expand support.

The degree to which access is universally available also varies widely and indeed the target audience has varied as well. In some universities, the goal was that *all* graduating students be familiar with and regularly used computers. In others, this was true for engineering and science students, but not necessarily those in the humanities. This has also changed over time, with more recent projects tending to expect universal access.

Virtually no developing country university has sufficient funding (or for that matter, building space) for all of the computers required to give all staff and students abundant access. In developed countries, many students own their own computers, easing the demand on the institution, but that is rarely the case in developing countries. SAREC projects tended to provide general purpose and/or teaching labs.

The existence of SAREC-funded labs has greatly increased Sida's visibility among students and staff at these universities.

3.1.4 Provide or improve general networking capabilities within a multi-campus university or multi-institution consortium

Connecting together multiple campuses of one university allows all campuses to benefit from the centrally provided services and Internet connectivity. It also allows the remote campuses to access and use central administrative system, and library resources such as journals and catalogues. As such, it would be reasonable that all multi-campus universities treat this capability as mandatory. That has often not been the case, with remote campuses either not being connected, or being a connected at limited speeds. The reasons vary, but they include lack of interest on the part of the remote campus' management, the lower status assigned to the remote campus by central management, and of course, the often high connection cost. Politics also play a large role, in that some remote campuses do not like the concept of not being fully independent. In cases where such multi-campus links have been a planned part of the SAREC project, they are generally implemented and effectively used.

Although the first project in Sri Lanka supported a multi-institution network including the connection of institutions not otherwise supported by SAREC, this has not been a common sub-project. Where inter-institution connections have been encouraged, they have been instrumental to helping the sister institutions to move into the ICT age. They can also facilitate regional research collaboration.

3.1.5 Provide support for general purpose, administrative and teaching applications within the university

The one infrastructure application component that has direct and visible impact on people is e-mail. The advent of generally used e-mail can be quite revolutionary. On campuses where there is often poor telephone availability, and a very hierarchical system which can make direct contact difficult, e-mail can bring upon remarkable changes. Where its use is accepted, it can shorten transaction times from days or weeks to hours or minutes. E-mail will be discussed in more detail in the sections on benefits to the various constituencies.

It is worth noting that in the absence of reliable, robust central e-mail facilities, there will still be considerable use of e-mail for those with Internet connectivity. These people will use the generic free e-mail offered by Hotmail, Yahoo, Google and similar providers. Although these systems can be quite powerful in their own right, their use can consume inordinate amounts of international Internet bandwidth – a scarce and expensive resource.

SAREC has not traditionally funded administrative and teaching applications, although that has changed in recent projects. However, in some cases other donors have stepped in and funded such systems based on the infrastructure that SAREC did help build. Such systems tend to have relatively long implementation cycles, and they are just coming online now. If successful, they will revolutionize how business and eventually teaching is done in these universities. In addition, in at least one case, INEC has funded course management applications, again built upon the base of the SAREC infrastructure.

3.1.6 Train ICT staff and end-users

Training within projects has taken two main forms. Most projects include some measure of training of technical staff. This is both reasonable and required since the entire concept of the project is to introduce new technology, and its use requires new knowledge and skills. This technical training has been described as one of the more important aspects of the SAREC projects, and it has no doubt been very successful. The measure of the success is that for some of the later projects, training and consulting has been performed by the earlier schools instead of by Sweden. A downside of technical training is that such trained staff is in short supply in developing countries and staff retention can be a major problem. Nevertheless, skills are typically transferred and replicated within organizations leading to sustainability.

Some projects also included funding to support the training of end-users. For institutions where there was very little ICT to start and which desire rapid integration, such training is essential. It has been moderately successful, although the process always takes far longer than originally expected.

One type of education that has not been included is project management training, including financial and asset management. These skills are important to the success of SAREC ICT projects, but it has typically been assumed that such skills are implicitly available. At times, this has been a reasonable assumption, but in other cases, as described in the section on project problems, these skills have been sadly lacking.

3.1.7 Improve library facilities in general, and more specifically, research reference material

True to the origins of the SAREC research infrastructure support, libraries have benefited from the ICT programs as well. At times, this has been more difficult than the true ICT aspects, because the ICT infrastructure was filling a need not previously addressed. In the case of libraries, there is a need to change how things are done from both the point of view of the library as well as the patrons. Effecting such change is often not easy and can be very traumatic.

The installation of library management systems is moderately easy from a technical point of view, particularly if the original collection is of a modest size as it often is in developing countries. Fully utilizing and integrating it with other university systems can be a longer process. At times, there has been a need to change or add staff who are more receptive to the new technologies.

The aspect of library upgrades that clearly has had the greatest effect is the large-scale availability of e-journals. The various programs now make it possible for a developing country library to have over 25,000 journals available to all researchers and students[13]. Those who use these journals now have access to *current* knowledge in a wide host of disciplines. This not only allows researchers to be informed about what is going on in their field, but implicitly provides opportunities for collaborative work.

There are, however, issues still to be resolved. Researchers in certain disciplines still claim that the literature that they need is not available. Reasons given include publishers who will not make their works available at discounted prices for developing countries, and disciplines that are so specialized that there is not sufficient interest to include them in the general packages of journals. While both of these have been true in the past, they are no longer really valid. Most publishers are now making their material available at low costs to developing countries. However, ensuring that libraries have the trained staff and budget to manage this large number of collections is problematic. Poor communications between researchers and libraries is also an issue – both libraries telling researchers what is available, and researchers telling libraries what they need. Overnight e-document delivery services[14] can address situations where specific journals are not available at any given point in time. It is still unfortunately common for researchers, even good ones, to be either unaware of the vast collection of e-journals available at their university, or to be aware of them, but steadfastly refuse to use non-paper resources. Lastly, bandwidth to most developing countries is still very expensive and thus limited, making online journal access quite slow at times. Bandwidth management techniques[15] can address this, but they are relatively rarely used in developing countries.

3.1.8 Improve post-secondary ICT training including post-graduate training and ICT research capacity

Under the SAREC ICT projects, 46 students have begun studies leading to doctorates. Of these, 17 started after 2003, and it is too soon to judge how they are doing. The following table shows the status of the first 29.

Country	Number of Students	Year Started	Current Status
Sri Lanka	8	1999	1 left early in program (left Sri Lanka) 1 Lic. 2003 (PhD almost complete, left program, left Sri Lanka) 2 Lic. 2003, PhD expected 2006/7 1 Lic. 2004, continuing in program 1 PhD 2003 (in Sri Lanka) 1 PhD 2004 (in Sri Lanka) 1 PhD 2005 (in Sri Lanka)
Mozambique	5	2001	1 Lic. 2004, PhD expected 2007 2 Lic. 2005, PhD expected 2007 1 PhD expected 2006 1 Lic. 2004 incomplete (left program, in Mozambique)
Tanzania	8	2001	2 Lic. 2003 (left program, in Tanzania) 2 Lic. 2004 (left program, in Tanzania) 2 Lic. 2003, PhD expected 2007 1 Lic. 2005, PhD expected 2007 1 PhD 2005 (in Tanzania)
Uganda	1	2003	1 PhD expected 2008
Vietnam	1	2002	1 Lic. 2006, PhD expected 2007
Ethiopia	6	2003	3 left early in program 3 Lic. expected 2006, PhD expected 2008

[13] Typically journal subscriptions are on a country-wide basis, and open to all education and research establishments. The price varies based on the country. As an example, for Tanzania, the entire collection would cost about US$78,000 per year. The same electronic collection would cost a US research university US$5,400,000 per year!

[14] Documents can be requested from major research libraries. They are scanned and the page images are sent via e-mail.

[15] Bandwidth management uses equipment placed between the institution and the Internet to give higher priority to "important" traffic, and lower priority to activities which are not as strategic to the institution.

To date, only 1 student has left the program after receiving a degree and not returned to their country. All other students who graduated with either a Licentiate or Doctorate have returned to their country and most are still working at their home university. Two students did leave their university for private sector employment after returning home with Licentiates.

For Swedish students, the "nominal" time to complete a Licentiate is 2 years and 4 years for a Doctorate. In fact, the typical times are closer to 2.5 years and 5 years. For the students who have already received their PhDs, the average time required was 5 years – exactly the same as for Swedish students. For the rest, the numbers are not quite as encouraging, but are nevertheless within a reasonable range. The average time to complete a Licentiate was 3.5 years, and the average time to for the projected PhDs is 6 years.

There are two apparent reasons for the elongated periods and perhaps for the number of students who withdraw after their Licentiate. First, the students have been selected by various means within their own country and have not been subject to normal admissions guidelines. As one would expect, some of these students would easily have met the Swedish admissions guidelines, and others may not.

Perhaps more important is the fact that in many cases, the students are working full time when they are in their home country. For many, their studies are completely inactive during those periods. In the case of the Sri Lankan students, most were "officially" on leave for the entire program, although they did admit to working part-time "to help out their department". There is some evidence that students who come from academic units have been given more opportunity to pursue their studies when at home than those who work for ICT service units.

It should be noted that some students leave after receiving their Licentiate because they do not feel able to complete a PhD, and some leave because their management at home decides that it is time that they return.

The issue of dissertation topics is also of interest. During the early years of the process, there was little thought given to whether dissertation subjects were particularly relevant to the student's home country. The theory was that the doctoral process taught a student how to do research – once the principals were mastered, they could pursue other topics in later years. This philosophy has started to change for several reasons:

– If many years are going to be spent learning about the dissertation subject, it may as well be in an area where the actual work will be useful in the context of the student's country. There is, after all, no shortage of applicable topics.

– It makes sense to start their research on a topic that they may be able to and wish to continue at home.

– If they work in a more esoteric area and want to continue it, they may find that the environment at home is not conducive to this – either because of insufficient infrastructure, or the lack of suitable colleagues to work with. Either may encourage them to move to some other country where the opportunities are better, thus losing them to their home country.

In one country, it was decided that the low level of existing ICT education warranted a different approach. Instead of bringing students to Sweden, Swedish university staff helped to build a functioning Masters-level education program within the country.

3.2 Project Benefits

One useful way to understand the impact of the SAREC ICT projects is to look at each of the many constituencies affected, and see how they have benefited from the projects. Of course, given the wide

variation in projects, not all benefits apply in each case, and certainly there is much variability due to individuals or groups not availing themselves of all possible benefits. Nevertheless, there is surprising uniformity across the various projects.

It is important to note that all of the following benefits are not just theoretical, but are being experienced with good results using infrastructure provided by SAREC ICT projects.

3.2.1 All university constituents

Computer literacy: In many cases, access to computers and the Internet at the university is the only opportunity people will have for such exposure. Providing basic computer skills to all staff and students of a university increases the country's overall computer literacy by non-trivial amounts.

Access to Internet for general use: Internet access is something that most educated people in developed countries now take for granted, but it is largely unavailable in developing countries. As with computer literacy, granting Internet access en masse to large numbers of people will inevitably effect change in unforeseeable ways.

E-mail (personal and professional communications): The benefits of e-mail which can span both distance and time at extremely low marginal costs are well understood. In an environment with poor and expensive telephone facilities, it can be even more effective.

Access to Office Productivity Tools: Although easy to forget, the availability of word processing and spreadsheets has changed how many tasks are done. If nothing else, rooms full of typewriters have now generally disappeared.

3.2.2 Researchers

Access current literature: Access to current literature is a keystone of being able to participate in the worldwide research community. The SAREC projects have enabled access to e-journals through appropriate arrangements with the material owners and the Internet connectivity and infrastructure to deliver the material to the user[16]. Not only does access to e-journals increase the actual availability of current literature, but by being able to deliver the material directly to a researcher's office or even home, it increases the probability that such material will be used effectively. In some developing country environments where the culture of research is not always well embedded, this is an important benefit.

Participate/collaborate with colleagues elsewhere: Collaborative research with colleagues in developed countries is one of the signs that developing country researchers are working to world-class standards. In a number of universities with more advanced ICT projects, the amount of collaborative research has increased markedly. Such research may also be a sign of colleagues in developed countries wanting access to data and resources specific to a developing country (often medical or environmental), and this type of collaboration is no doubt of benefit to the country. The availability of e-mail, the web and other file transfer mechanisms has allowed participation on developed-world timescales[17].

Connectivity also facilitates collaboration within a country and region. Moreover, such connectivity and collaboration have also led to the publication of regional journals in a number of disciplines.

Submit, edit, review papers, theses: As with the previous item, electronic transfer of documents has allowed time-scales to be drastically shortened. One good example was the case where the external review of

[16] E-journal access has been facilitated by organizations such as the International Network for the Availability of Scientific Publications – INASP, an organization supported by Sida; and Health InterNetwork Access to Research Initiative – HINARI, a program of the World Health Organization. INASP has also been instrumental and notably successful in helping libraries and their staff adapt to this new non-paper based world.

[17] Fax can be used, but it has never been a popular medium with researchers, can be expensive, and is impractical for large documents.

doctoral theses has been shortened from 6–12 months to a few weeks. Similarly, researchers in developing countries may now be called upon to be reviewers, whereas before their participation would unreasonably lengthen the process.

Receive information on conferences, submit papers: Prior to the availability of e-mail and the web, it was common to receive a flyer or journal discussing a conference *after* the conference had already taken place, and certainly after the deadline for submitting papers. Attendance and speaking at academic conferences has increased markedly since the advent of electronic access.

Access to resources otherwise difficult to obtain locally: This benefit refers to a wide range of advantages brought about by electronic access. A simple one, but of significant impact, is the ability to quickly and easily order chemicals or equipment online via the web.

ICT can reduce costs and time-frame for research: Although this bullet overlaps somewhat with the previous ones, it neatly summarizes many of the overall benefits resulting from the SAREC projects.

3.2.3 Instructors

Course material preparation and presentation: In the simplest case, computers are a great aid in preparing and presenting course material. However, with the addition of the web, there are great opportunities for curriculum enrichment using a wide range of materials freely available on the Internet. Such materials even include full courses from many respected universities. Web-based materials can be used explicitly (that is, point the students to them) or even better, used as a resource with which instructors can judiciously blend into their courses.

Communications with students: Electronic communications (e-mail and specialized web-based e-learning tools) can be used to augment traditional "office hours" for interacting with students. They can also be used to distribute class notes and assignments, and receive assignments. For sociological reasons that are not entirely clear, e-mail partially overcomes the traditional class and social status structures and sometimes makes it easier for "unequals" (in this case students and instructors) to interact.

E-learning: Course material can not only be created and distributed with the support of ICT, but the course material can be ICT enabled. That is, the actual teaching methodology can use ICT capabilities. This opens the door to self-paced learning; e-laboratories that do not require expensive physical infrastructure; and simulation, allowing principles to be explored that would not be practical in real life, and certainly not with students having hands-on control over the experiment.

Assignment legibility: In some universities, students may no longer submit hand-written assignments. For instructors who have to grade large numbers of assignments, this is a non-trivial benefit.

Plagiarism control: With the advent of network-connected computers, students have the opportunity to find existing works and submit them as their own. Luckily, there are also tools for instructors to help identify plagiarism.

3.2.4 Students

Course related communications: This of course includes the reverse side of the communications uses mentioned under Instructors, but also includes student-to-student communications.

Research and online learning resources: The traditional learning models in many developing countries have the teacher as the sole source of all knowledge. With the access to network-based information access, students can now seek out other information sources. Locating potentially obscure information in a physical library has always been a task for a reference librarian or true researcher. With web-based tools such as Google and the Wikipedia, anyone can now be amazingly successful. Moreover, textbooks and other paper-based materials are often in short supply, and the network based materials, both locally provided and from the Internet, can help supplement or supplant

paper texts. Students (including undergraduate students) also quickly learn to make effective use of e-journals.

E-learning and Distance Learning: Computer and network access can allow students to participate in university programs even if they are not physically situated at the university centre. In countries where the interest in post-secondary education far exceeds the enrolment numbers allowed by physical infrastructure and budgets, this is becoming a great asset.

Split – MSc/PhD Programs: The split graduate studies programs funded under the SAREC programs would be less effective without good communications. Such communications not only allow students to remain in touch with their advisors while back home, but allow good communications with colleagues and family while in Sweden, increasing both quality of life and decreasing demands that the students spend more time at home. This latter aspect admittedly may tend to decrease the student's focus on studies while in Sweden, but it is far better than having them withdraw from the program.

Online access to administrative systems: For students enrolled at universities with advanced administrative systems, online access to allow retrieval of marks or registration for the next semester is a great benefit. This is even more important for distance learning students who might otherwise need to travel to the university.

3.2.5 Administrators

Office/administrative systems: The impact on administrative staff will be highly variable, depending on the starting and ending points in each case. In the extreme, the change is from a starting point of no computer to the other the extreme of network-connected computers at every desk and central servers managing financial, student information and human resources databases. In the typical case with SAREC projects, the impact has been modest, with computers used primarily for traditional office applications such as word processing, spreadsheets and e-mail. In theory both the entry-level and major applications have the potential for increasing productivity, although such benefits are not often delivered. However, both well-designed desktop applications as well as the major applications do have the realizable potential to increase effectiveness and control in very major ways. For instance, in one case, the time to generate a student transcript on demand has been reduced from one year to a matter of days. Staff training is often problematic in such environments, but surprisingly, this has not been reported as a major problem in the SAREC projects.

Specialized applications: In addition to the major applications such as finance, there are a number of specialized applications that are starting to be used. Examples are classroom and exam scheduling. Both of these relate to tasks that have traditionally been done by hand. In the case of classroom scheduling, computer-based techniques have the potential for better utilizing classroom, lecture halls and lab – all resources that are in short supply, and all resources that have traditionally been under-utilized.

3.2.6 Libraries and their Patrons

Although not truly a separate constituency, the impact of ICT on libraries and their patrons is profound and needs to be addressed.

E-journals, CD-ROM reference material: The transition from paper to electronic material, whether on CD/DVD locally or via the Internet, is truly the one of the most revolutionary changes affecting a modern university. It has allowed a core change in how research is done at the professional and student level. It is also one of the many drivers requiring universities to acquire more and more Internet bandwidth.

Library Information Systems: Library Information Systems (LIS) typically include all of the applications required to run a library – online catalogue, circulation, acquisitions and purchasing, and cataloguing. Unlike many such automation systems, a LIS can truly eliminate virtually all paper-based transactions in a library. As such, its use creates quite a marked change from the traditional library, and it typically takes significant time to integrate it and for all staff to be trained and adapt. Adaptation is sometimes

difficult. Most patrons, on the other hand, adapt almost instantly to the new systems, and often usage of libraries increases due to the new ease in accessing information. Although none have been implemented under SAREC projects, some libraries opt for just an online catalogue and circulation system, addressing the customer end of the library, but none of the "back-office" operations. Such systems eventually need to be replaced by a full LIS.

3.2.7 External community

Although not a participant in the SAREC projects, the community outside of the university is a large benefactor.

Skilled graduates: For most if not all of the SAREC supported universities, the ultimate goal is that all university graduates be reasonably computer literate, and that Computer Science and Engineering departments generate an ongoing stream of highly skilled technologists. If a country is to start using ICTs to address problems and help run its businesses and government, this combination of graduates is essential. Moreover, the graduates in the technical programs are likely to be quickly employed, and for the graduates in the rest of the programs, employment opportunities will be larger because of their computer skills. In all reviewed countries, ICT-literate and ICT-skilled graduates are addressing market needs.

Access to selected non-degree courses: Virtually all universities that develop ICT expertise provide a range of non-degree courses aimed at the community at large. They do this both as a public service and to generate revenue. Typically they offer various certificate and diploma programs. The material may cover standard applications and basic skills required by industry as well as courses certified by multinationals such as Microsoft, Cisco and Oracle. As the universities and countries develop more advanced services, distance education for both degree and non-degree courses become possible. Most countries are also developing private sector education providers, but the university courses are generally viewed as being of higher-quality. As the first country to participate in the SAREC ICT program, Sri Lanka is perhaps the most advanced, and all of these services are indeed being developed there.

Services to the community: As the use of technology within the university grows, individual staff members become quite skilled at its use. In some cases, this expertise has been used to serve the community outside the university in specialized ways. The best example of this is in medicine, where various medical outreach programs have been piloted. Although it is difficult to attribute these programs solely to the SAREC ICT projects, it is clear that the projects have given the universities a level of technology and experience that contributes to these developments.

Internet Access: In most countries (both developing and developed) the Internet has first been introduced in universities, and then slowly migrated to the rest of the community. Often, the university is an early supplier of Internet to government departments and is the country's first ISP. In countries where SAREC was an early supporter, this local introduction of the Internet can be partially attributed to SAREC's help. Moreover, those in the university and government who are first exposed to the Internet have helped create the demand for private sector Internet providers.

It should be noted that these benefits to the community outside of the university have generally not been planned ahead of time. In light of the fact that some of these benefits appear in virtually all projects, there may be merit in considering such potential results during the planning process. Proactive outreach from universities to the wider community is generally viewed in a positive way.

3.3 Sustainability

Planning for sustainability has been a crucial component of all SAREC ICT projects and is a critical factor in their evaluation. For a project to be considered sustainable, the university, either directly or

with the support of the local government, must make provision for funding salaries, maintenance and repairs, consumables, and required services (such as Internet connectivity). Moreover, technical capacity must also be sustained. For the few projects that have been completed, the success rate is quite good. For projects just completing, there seem to be some cases where sustainability has not been met, but will with relatively minor program extensions.

A more serious concern is that in some cases, the items included in the sustainability equation have probably not been adequate. That is, the project will be sustainable based on the predicted post-project expenses, but that list of expenses has been underestimated. It must be noted that underestimating projected maintenance and replacement costs is not unique to donor-funded activities or developing countries. But it is a bit more worrisome in these cases, because the options for finding additional money when it is "suddenly" needed may be more difficult than in non-donor-funded areas.

3.4 Expect the Unexpected

During the reviews of SAREC ICT projects, one of the norms has been the discovery of benefits that were either completely unplanned and unexpected, or that were expected, but not anywhere near the level ultimately experienced.

In ground-breaking projects such as these, part of the unspoken rationale is:

> "I cannot define exactly what the major benefits will be, but trust me, they will be more important than we would guess."

Such rationales are not typically included in business plans, but the belief that a project is *important* is a crucial part of taking the risk that such projects entail. In this case, the evidence from the early projects is that the risk was completely justified, and the long-term benefits far outweighed the costs[18].

The examples that follow are drawn from the four projects that have been examined in depth by the evaluators, coupled with information gained during the workshop in Tanzania. There is no doubt that other new unexpected benefits would be revealed if other projects were reviewed in detail.

3.4.1 The University as an ICT Resource

In many cases, the SAREC ICT project is one of the first large-scale ICT projects in the country. Once the project gets going, the university people who are managing it and doing the actual technical implementation become a major resource to be drawn upon by both the public and private sector. These de facto experts become key players in strategic technology projects.

This simple description does not do justice to the import of this benefit. The educated elite in many developing countries is quite small, and there are numerous family, social and business connections. Once it becomes understood that a particular small group of people truly understand computer and networking technology, they end up being invited to participate in a significant percentage of critical implementations. In fact, their very presence will often encourage things to happen that would otherwise not even exist.

3.4.2 Model ICT Plan

In a number of SAREC ICT projects, the first step has been to create an ICT policy statement, describing how the university plans to use technology, and what its long term goals are. Following this, a detailed operational plan is developed specifying exactly how these goals are to be approached, and

[18] This same phenomenon is often referred to as the Law of Unanticipated Consequences – Actions carried out for a specific purpose will often have other results. This law is often used to describe negative outcomes that were not anticipated, but as in the case of the SAREC ICT projects, the unanticipated consequences can also be very positive.

what the intermediate steps are. A key aspect of this is breaking down the requirements into approachable pieces and prioritizing them, acknowledging that funding will be limited and that not everything can be accomplished at once.

Based on the successful use of this planning model, in at least one country, various government ministries have used the model for the basis of their own plans. In fact, the overall government ICT policy was derived from the same model. It is estimated that by using this demonstrably workable model, the various government ministries gained a year or more over starting from scratch.

3.4.3 Core ICT Infrastructure Leads to Further Investment

For the projects that started with a policy and planning exercise, donor cooperation was an integral part of the process. Once the plan had prioritized the various needs, donors were identified to fund the majority of the top projects. Since the SAREC projects tend to fund core infrastructure, the projects supported by other donors tend to build upon this base.

For projects without the unified planning stage, there was no original process to involve other donors. However, as the SAREC projects have been implemented, the result has been a university capable of building upon the core infrastructure and it has been easier to attract other donor funds. A simple example is the donation of specialized engineering software made possible because the Faculty of Engineering already had the basic lab funded by SAREC. At the other extreme, there are major World Bank or Asia Development Bank projects made possible because of the core resources provided by SAREC. Effectively the SAREC funds have been leveraged to increase their value by having other donors build upon the infrastructure base.

The above notwithstanding, it is important to note that some universities, and more particularly parts of universities, have been far more successful at involving new donors than others. In a number of cases there is an attitude that "XXX has adopted us – it is up to them to help us". It is never spoken that way, but there seems to be such a tone to conversations about how to fund future advances. At least part of the problem is that many people do not know how to write a clear, strong project proposal.

3.4.4 Access to the 2006 Internet

When the SAREC ICT projects were begun in the late 1990s, it would have been difficult to imagine the Internet as it is today. Courseware from some of the world's most respected institutions is available online for free. MIT makes its virtual laboratory (iLabs) available for free. Researchers and students can access over 25,000 current journals at relatively modest cost to the university and country. Open Source software is being developed to address many needs of universities, and is available with no capital cost[19].

All of these recent developments could not be predicted with any certainty eight years ago. One has to assume that there will similar advances in the years to come, continuing to increase the net benefit from the SAREC ICT projects.

3.4.5 ICT Awareness

Through both deliberate outreach as well as the domino effect of graduating ICT-literate students, the presence of an ICT centre of excellence on a university campus slowly spreads ICT awareness throughout the community. For campuses that are in rural areas, the effect is likely even more pronounced.

ICTs are not a magic bullet that will wipe out poverty, but there is mounting evidence that ICTs will play an increasing role in poverty alleviation efforts. Early efforts to simply place technology, often in the form of PCs and Internet access, in the hands of the poor did not produce consistent and sustain-

[19] Open Source software often requires local skills and development/support investments so it should not be thought of as "free". But it can often be far less expensive than traditional commercial software.

able benefits. However, using ICTs as tools to solve real problems is increasingly generating measurable anti-poverty benefits[20]. To this end, increased awareness, acceptance and understanding of new technologies is a move in the right direction. Moreover, to use ICTs as enabling tools, it is essential that there be a critical mass of highly skilled ICT practitioners available in the country.

3.5 Major Problem Areas

The previous sections describe the benefits of the projects. However, there were and are projects that have not met expectations. Of the twelve projects, four have experienced major problems, but only one has been outright abandoned. The following sections describe these four projects, ordered from worst to best.

3.5.1 Project A: Infrastructure Project Cancelled

This project was originally scheduled to run for two years starting in 2001. It was a novel project, and unlike its predecessors. There was very little progress, and the project was extended to 2004. By the end of 2004, with still no real progress, an external review was commissioned. Based on this report, the decision to cancel the project was taken. To a large degree, the major expenditure from project funds was that allocated to the Swedish partner, staff training and doctoral studies – relatively little funds were spent in-country. For any failure like this, there are many different views as to why the project failed and what could have been done to save it. However, all of the following certainly were contributing factors:

- The technical design in 2000 was too short-sighted and if implemented, would have been outdated or insufficient very early in its life.
- The project was partly designed to address telecommunications regulatory and pricing issues that changed prior to the planned project deployment.
- The local agency that SAREC contracted with seemingly did not have the budget, staff or authority to follow through.
- Internal politics complicated the in-country decision-making process, as did a competing parallel project.

3.5.2 Project B: Poor Oversight and Controls

This is a project which is still progressing and has to some extent been successful. However, there have been many problems identified during audits and reviews. The major factors were:

- The level of ICT expertise in the country and university at the start of the project was extremely low.
- Cultural and language problems complicated things, and changes factoring in these issues were not made.
- Poor equipment selection and site engineering.
- Questionable purchasing procedures in violation of local law and Sida rules, possibly bordering on fraud (but impossible to prove).
- Poor record keeping and inventory control, some of which covered improper use of funds.
- Sustainability issues.

[20] Most donor agencies have been looking at the link between ICTs and poverty alleviation for the last two years, and there is a growing body of evidence showing the clear link, although perhaps not the one that had been envisioned over the last decade. See section 1.4, paragraph 1 for one recent citation.

Nevertheless, although it is clear that the value-to-cost ratio was poor, significant benefit has been received. The most recent audit advises that additional funds be spent under strict supervision to protect and enhance the current infrastructure and ensure that it continues to give value in the future.

3.5.3 Project C: Unclear Status

One project is in a rather curious state. A fair amount of work has been done, and reportedly done well. But due to turmoil in the country and the university, and multiple personnel changes, to date it has been difficult to determine exactly what the current status is, or what needs to be done. There has been an interest in performing an external evaluation since late 2005, but for various reasons this has not yet happened. E-mail communications seems to be particularly poor, especially after a change of local personnel; the Swedish partner reports that a local visit is always required to establish rapport before e-mail can be practically used. The Swedish partner reports that the project is reasonably under control, but no other evidence was presented during the present evaluation. Clearly an on-site evaluation is required, likely with local contact initiated by Embassy staff.

3.5.4 Project D: A Bad Start

This project is in fact doing moderately well, but the early years were not easy. The project made little headway for several years and in hindsight, it would appear that the local project leaders combined with their Swedish counterparts were simply too inexperienced to recognize the problems and take effective remedial actions. This resulted in a combination of unrealistic schedules coupled with the inability to move the project along.

A new and experienced Swedish partner coupled with the hard lessons learned by the in-country project management team has now gotten the project back on track. There are still issues to be resolved including:

– difficult purchasing practices in the country;

– the potential unsustainability in the short term due to the project prolongation;

– poor communications among various Swedish participants;

– delays and uncertainty due to the questionable decision to develop all software in-house[21].

However, with some flexibility from SAREC over the next two years, this will likely be a successful project.

3.6 Other Problems

Although not on the project-threatening level there have been a number of other problems, some repeating issues that were apparent from the major problems previously discussed.

3.6.1 Financial, purchasing and inventory control practices

Many developing country universities do not have systems, staff or at times the cultural tradition to help ensure that Sida norms are followed. Moreover, in some cases it may not even be understood what those norms are. To date, there have been no cases identified of clear fraud. There have been cases where staff members have received payments in violation of project budgets and Sida rules, where funds have been diverted without discussion from budgeted areas to new ones, and there are certainly cases where the paperwork is insufficient to justify 100% confidence.

[21] The rationale for developing in-house software is that it can be tailored to meet your needs and there will be no ongoing maintenance charges. However, even using Open Source development tools and core software developed elsewhere, this is a major, time-consuming endeavour which may replace charges to external vendors with the need for additional staff and potentially long delays before the software is ready.

There is a tendency in recent projects to allocate many of these responsibilities to the Swedish partner. With the selection of a competent partner (as has been the case), this remedy *will* address the original problem. However, there is some worry that although this level of hand-holding protects the Swedish investment, it does not help provide the skill levels that will be needed by the university to manage the infrastructure and follow-on projects after the completion of the original SAREC project.

3.6.2 Schedule slippage and poor time-line projection

This has been a very common problem. The cause is clear – the people doing the projections have never implemented this kind of ICT project before and did not understand the complexity or the staffing implications. Staff retention issues can also be problematic. Equipment acquisition which has multiple steps and often arcane tender and purchasing procedures is often poorly understood at the start of projects. Regulatory issues can cause significant delays for both Internet connectivity and radio installations. It is unclear if Swedish partners or SAREC gave any warnings about the potential for building over-aggressive schedules, but if so, they were probably ignored by over-eager and potentially over-confident project leaders. The problem is certainly made worse by the tight funding time-line typically imposed by SAREC – that is, most of the money must be budgeted to be spent in the first two years of the project.

3.6.3 Poor Project Management

At least some of the problems experienced can be attributed to poor project management skills on the part of the project leaders and/or the Swedish partners. Such skills are obviously needed, but there does not seem to have been any real regard to attempting to verify that such skills were present or to provide training as part of the project. Annual reports and plans tend to be sketchy and often do not adequately reflect the problems that are being encountered. There are no clear guidelines with respect to the project management role of either Sida or the Swedish partners.

3.6.4 Swedish Partners

There have been a number of issues raised regarding Swedish partner universities. These include:

- Some universities and individual project members are extremely knowledgeable about developing countries and what kind of help they need, but some have been less so. Typically, more support is needed during the beginning of the introduction of ICT, and less once the university becomes more experienced.
- It is unclear what, if any, pre-project activities are undertaken to get new partners up to speed regarding exactly what their responsibilities are.
- The amount of support a developing country university needs (or wants!) varies widely. Support options could include:
- Technical support
  - Equipment selection
  - Procurement
  - Project monitoring
  - There has been some resentment regarding Swedish partners – specifically that they increase costs without adding value. Also, some universities add "overhead" charges that are thought to be unreasonable.

3.7 Summary of Evaluation Issues

The Terms of Reference for this evaluation called for an analysis based on five criteria.

Effectiveness: With the exception of the one cancelled project, and the one in unknown state, the projects have achieved their original objectives. Moreover, in all of the completed projects, they have directly and indirectly generated benefits far in excess of original plans, and there is good reason to believe that the ongoing projects will have similar outcomes.

Relevance: The projects meet real needs of the university and the university constituencies. In most cases, they have been planned so as to continue serving those communities for the indefinite future. The projects certainly address Sida's priorities. They address SAREC's priorities as well, and to the university's and the country's benefit, these SAREC policies have been interpreted in the widest and most supportive ways.

Impact: As noted under effectiveness, the benefits and impact have been large and wide ranging. In fact, it will take a number of years to truly understand the impact not only on the universities, but on the wider communities in which they exist. The negative effects tend to be those that automatically come with such ICT development: the need for additional funding for expansion and support, and the need to adjust remuneration to keep newly trained staff within the university.

Sustainability: Sustainability had generally been accommodated. It is unfortunately a fact of life both in developed and developing countries that ongoing costs always tend to be higher than estimated. It then depends of the skill of the both management and the technical staff to balance the needs and budgets. As long as there is an honest effort to address sustainability, the SAREC projects will be well served.

Efficiency: The successful projects have used funding reasonably with the exceptions noted in the report section on problems. Most projects have been implemented in a reasonable time-frame – typically longer than originally projected, but that is often a reflection of over-ambitious schedules and SAREC funding guidelines more then inefficient implementations.

4. Conclusions

4.1 Lessons Learned

There are a number of critical lessons that were brought to light by both the successes and failures.

– Subject to the issues reviewed in section 3.5, the ICT support model used in the SAREC projects has been both effective and appropriate.

– In successful projects, the benefits can far exceeded those that could reasonably have been predicted. SAREC entered into the first programs partly as a matter of faith – the belief that ICT was important to universities, and this faith has been re-paid many times over. In at least several of the early projects, the university investment has had an influential effect helping to start the use of ICT in the country. The core ICT infrastructure funded by SAREC has been used as a platform on which other donors have based their contributions. This catalytic effect has greatly increased the value of SAREC original contributions.

– ICT can be a university rejuvenation enabler. Although ICT alone cannot address structural problems, it can help address process issues. Moreover, for a university that was operating much as it had for decades, the sheer change brought about by the addition of ICT seems to be able to instigate other change as well. This has been particularly true in libraries.

– Success requires a receptive environment and local champions who are empowered to carry out projects (the opposite is also true: projects should not be entered into if players cannot demonstrate that they have the interest and authority to follow-through). The projects where the success is most evident always have dynamic project leaders who have a vision of what they want to accomplish. It is clear that a donor such as SAREC cannot mandate that the project leader be dynamic and has vision, but when such people are involved, it is important that they be recognized and given the opportunity to do their "magic".

– Project management should be part of the project – handholding is important and often required at the start, but there should be a plan to eliminate the need for it in the long term. In the best cases, this happens automatically. In other cases, deliberate action should be taken to ensure that it happens. A large part of successful management must be a regular and effective reporting and planning process.

– Although the role of the Swedish partner has at times been relatively minimal, the partner must be sufficiently experienced and skilful so as to recognize when they are needed and when they are not. It of course also helps if the partner is committed to development.

– Project methodology must address the need to identify projects in trouble early in the process.

– SAREC lost a valuable resource when their ICT Unit (now ICT for Development Secretariat) was transferred to INEC. Although this move was undoubtedly an important one for Sida, it left a hole in SAREC's expertise that was not sufficiently filled by the new arms-length relationship with the ICT4D Secretariat.

4.2 Reasons for Project Success

It would seem that the SAREC university ICT projects have generally had a major impact on the use of technology both within the supported universities and the countries. When one looks at the benefits, the cost has been reasonably modest in most cases. Moreover, the success rate is high compared to many development efforts. It is worth trying to identify the reason for this relative success. At least part of it is that the project leaders and their management passionately wanted the project to be a success. It was more important to them that the project succeed than that they made a personal profit or simply ignored the SAREC project and went on to other endeavours[22]. This level of belief in the project targets, and the determination to ensure success, are no doubt major reasons for the ultimate success and benefits reaped.

Perceptive and competent mentoring by the Swedish partner was also a factor in some projects.

4.3 Is the job done?

There was a strong indication that SAREC management feels that with regard to its ICT infrastructure projects:

1. SAREC has played a significant role in improving their supported universities' ICT readiness.

[22] Such "dedication" has been attributed to truly caring about the institution adopting technology. It has also at times been claimed that they may be doing it for their own glory. Regardless of the reason, the end-result has been beneficial.

2. Based on the original targets, researchers are reasonably being well served.

Accordingly:

3. There is no need to fund additional projects enhancing university ICT infrastructure.

The two premises and the conclusion bear careful analysis.

4.3.1 SAREC has played a significant role in improving their supported universities' ICT readiness.

Based on the results observed from projects that are at or near conclusion, and on the reports from projects still in process, there is absolutely no doubt that this is true. In fact, the impact on all parts of universities and the community in general is far higher than could ever have been imagined at the start of the projects. The supported institutions are integrating the use of ICT into all aspects of their programmes and activities, and are generally well positioned to continue the process. Many graduating students are computer literate, and that will in the long term, help to increase the country's competitiveness.

4.3.2 Based on the original targets, researchers are reasonably being well served.

This is also generally true. To a large extent the SAREC ICT projects have allowed typical researchers in a developing country to compete on an *almost* level playing field with their counterparts in developed countries (from an ICT perspective). The word *almost* covers two substantive areas:

– Internet bandwidth is quite insufficient in most developing countries and this hurts their ability to fully benefit from the ICT investments. The reason is simple – the cost of Internet bandwidth in developing countries is 20 to 60 times what it is in developed countries. Most connections are via satellite, and even when terrestrial connections are available, the prices do not decrease much. As an example, a university with very modest needs in Africa may use a satellite link providing 3 million bits per second (Mbps) from the Internet, and 1 Mbps to the Internet. If the university is a very good negotiator, the cost for this 4 Mbps total may be as low as US$7,500 month. In Canada, this amount of money will buy 100 Mbps – in both directions[23]. Added to this, bandwidth management techniques and equipment which can help make more effective use of existing bandwidth are typically not used.

– Computers are in short supply for researchers and their graduate students. Research grants can be a source of funds for computers in some disciplines, but even when that is an option, it is often at the expense of travel funds for conferences or journal publication fees.

It is generally accepted that the universities do not expect SAREC or Sida to fund either bandwidth or computers on an ongoing basis. Therefore there is no real question about SAREC extending programs to address these needs.

4.3.3 Should university ICT infrastructure support be extended?

It is far less clear that these two major successes imply that the job is complete. There are a number of reasons which all focus on the need for universities to be robust, ICT-oriented institutions:

– Due to the high variation in projects, many universities are still missing major ICT infrastructure components. The most apparent example is a Financial Information System (FIS). Although it is possible to have good financial controls without resorting to computer systems, it is becoming increasingly difficult to do so and even harder to properly audit. Just the existence of a good FIS can have anti-corruption benefits. For a university that expects to be managing research grants and

[23] Although the two examples illustrate typical costs, they also are close to the actual expenditures and bandwidth received at the University of Dar es Salaam in Tanzania, and McGill University in Canada. McGill is also connected to a gigabit research and education network for communicating with other universities.

donor funds, an FIS is increasingly mandatory. Other examples are Library Information Systems, Academic Record Information System (ARIS)[24], and e-learning course management systems. All of these systems have been included in one or more of the SAREC projects, but are still not present in many of the universities. Although it is possible and preferable that other donors provide help in these areas, it is critically important that someone fills these gaps in the near term, protecting and expanding upon the investments that have already been made.

– The environment has changed a lot since the original projects were started, and there are new demands that are increasingly important to both researchers and universities in general. Examples are bandwidth management, wireless network access, computer and network security, centralized file storage, backup systems and web portals. All of these are increasingly and urgently required for any organization that is relying on ICT for mission-critical services.

– Although the very first SAREC ICT project was primarily to build an inter-university network in Sri Lanka, that project was quite ahead of its time. Now, over ten years later, such networks are still not the norm throughout the developing world, but their importance and interest in them has increased radically over the last few years. As was proven true in Sri Lanka as well as other developed countries, local/city, national and regional research and education networks can play roles far larger than just being a network provider. They can form the basis for technical and research cooperation between member institutions on many different levels. Inter-university networks can also drive the effective use of e-journal subscriptions which are typically available to the entire country's research and education community. SAREC can play a major role not only as a possible donor funding such developments, but as a champion and facilitator helping to ensure that these emerging networks can be viable and successful.

– It is clear that there is one critical issue facing all of the universities that SAREC has supported as well as all others in developing countries – Internet bandwidth. As long as these institutions must pay 20 to 60 times the price paid by their counterparts in developed countries, their researchers and students will always be poorly served. Methods must be found to make Internet connectivity available at more reasonable prices. The methods will surely vary depending on the local situation, but it is important that Sida and SAREC use all the tools at their disposal to help the situation. In Africa, where Internet prices are highest, there are several initiatives looking into providing Internet access at drastically lower prices. These initiatives should be supported. As well Sida should look for opportunities to help make available lower Internet access prices for higher education through regulatory and policy initiatives.

– In the developed world, most large research universities have access to very high-speed gigabit networks. These networks interconnect research organizations and tend to support leading edge research. Such networks are usually over and above connectivity to the traditional Internet, although in some cases, they are also used to provide Internet access. There are a number of initiatives around the world to bring such high-speed networks to developing countries, and this may be an area that research-focused SAREC may wish to consider.

4.4 SAREC-supported Graduate Education

Given the constraints that it has operated under, the ICT graduate studies program has done relatively well. The program has become more centred on developing ICT professionals than on developing research capacity. This not unreasonable, but it is important that future student selection processes clearly differentiate the two outcomes.

[24] A modern Academic Record Information Systems not only manages the data, but allows students to access their marks and similar information, determine degree completion options and requirements and register for upcoming semesters. Instructors can submit marks and manage class lists.

The selection process for Masters and Doctorate students needs to be reviewed to ensure that the students selected are sufficiently prepared both academically and linguistically. The terms under which students may work full-time while in their own countries should also be clearly defined. These students are typically employed prior to their Swedish studies, and their home departments are invariably short-staffed, so there is little hope that a "no work" rule can be enforced, but the current situation does need to be adjusted.

Although it is difficult to guarantee, efforts should be made to ensure that students who earn degrees under this program continue to serve their home universities after they return.

4.5 The SAREC ICT Projects as a Model for Future Initiatives

In reviewing the ICT status of the institutions supported by SAREC, it became apparent that there is another issue that must be considered. This is the issue of the other universities in SAREC-supported countries or even those institutions in countries which Sida supports, but not SAREC.

In most cases, the level of ICT development in these institutions is far below than that seen in those currently supported by SAREC. In some cases these are research universities and could be considered to be within SAREC's current mandate. In other cases, they are clearly not "research" organizations[25]. However, just as it was important to make ICTs available in all parts of the universities that SAREC has already supported, it is crucial for the country's ongoing development that *all* post-secondary institutions have modern ICT infrastructures.

Currently, Sida does not explicitly support higher education in general. However, Sida does have more than a passing interest in helping the countries that it supports to reduce poverty and to develop good government and a vibrant industrial sector. Universities and other post-secondary institutions are the sources of the people who will ultimately make this all happen. Sida should revise its strategy to encompass the selective support of ICT in post-secondary education.

Future government employees or leaders or entrepreneurs do not graduate only from SAREC-supported universities – they come from other schools as well. All such institutions must move into the modern ICT age and all students should receive a good grounding in computer and Internet technologies[26]. This rationale potentially applies to all countries that Sida supports, not only those currently supported by SAREC. However, SAREC-supported countries have a strong advantage – the current SAREC universities are proven local examples of the benefits of ICTs, and can act as mentors to other institutions.

It is clear that the task just described is a large one and not one that Sida can do alone. Moreover, there are benefits to working cooperatively with other donors to both divide the cost and minimize the creation of duplicate infrastructure. The experience gained by Sida in the current university ICT programme is unique. Sida should use this proven position of leadership to create a donors group to begin addressing the larger problem.

[25] One could make the argument that *any* post-secondary educational institution ultimately feeds into the country's research capacity, but this is not at all a strong argument.

[26] Although ICTs are not a magic formula for poverty alleviation, it is increasingly difficult to imagine that countries will be able to address poverty issues (in its widest definition, not purely financial) without using ICTs as enabling tools. To do this, it is increasingly important that its university graduates are all ICT-literate.

5. Recommendations

The SAREC university ICT infrastructure programme has created significant benefits, often far in excess of expectations or cost. As a result, researchers at supported universities are much more able to compete with their counterparts in developed countries, and the overall quality of education is being measurably improved.

At the same time, discussions with users readily reveal areas where these universities still lag behind their counterparts in the developed world. It is similarly apparent that despite such deficiencies, the supported universities are light-years ahead of most of their sister institutions in their own countries. This sharp division between ICT-focused universities and their less fortunate compatriots has created a new education digital divide[27]. Addressing this problem is a big task, and not one that Sida can do alone. Sida is encouraged to consider ways in which multiple donors can work together to jointly start to address these issues.

Recommendations 1, 2 and 3 address needs of SAREC's traditional constituency, with 2 and 3 being of particularly crucial import to researchers trying to compete in a global research world.

1. Evaluate requests for further grants from currently or formerly supported universities based on the university's current level of ICT development, success of earlier projects, opportunities for support from other donors, and a new profile of what infrastructure services a full-function ICT-oriented university should be able to deliver. This profile should include a high-bandwidth campus network; robust, mission-critical systems for e-mail, web services, FIS, ARIS, LIS, e-learning; bandwidth management; wireless access, security; file storage and data backup; and a cohesive education plan for technical services, staff and students.

   Rationale: All of the items listed are either supported in existing SAREC projects or are requirements driven by current technology problems, some of which only appear once the university has started to *depend* on initial ICT infrastructure. Ultimately, any university that is to rely on its ICT services will need to provide all of the listed services. Part of the test for acceptance of such projects should be that the requesting institution demonstrates why other sources of funding are not readily available.

2. Support activities to build inter-university networks at all levels (city, country, regional) and support activities such as conferences and workshops to advance national and regional university ICT cooperation.

   Rationale: Just as the LEARN network in Sri Lanka made sense in 1998, similar networks throughout the developing world still make sense today. They allow universities to share critical resources and particularly Internet connectivity, thereby increasing buying power and improving redundancy. Researchers can easily work with colleagues at nearby universities. Resources shared can include library reference material, e-journals and courseware. Even administrative systems can be shared if the universities have the willingness to do so. Over and above sharing a physical network, inter-university networks are very effective in getting the university technical staffs to work together, and this type of cooperation can be as important as the actual network benefits. Among other things, it can lead to shared and joint support staff which can be extremely beneficial in environments where people with high-level ICT skills are in very short supply.

[27] The traditional use of the term *digital divide* has been rightfully criticized as simply one of many divides in developing countries, and more of a symptom of overall problems than a problem that must be bridged by massive transfusions of technology. The digital divide between post-secondary schools in the same country, however, *can* be addressed by careful investments in technology infrastructure and education.

3. Where appropriate, support interventions that will ultimately help make bandwidth available to developing country universities at prices competitive with those in Western Europe and North America. Interventions can be in the form of monetary support to consortiums attempting to acquire bandwidth for research and education purposes. They can also be in the form of advice on regulatory and policy issues which can similarly lead to lower prices in general, or for educational institutions in particular. Consideration should also be given to supporting initiatives to bring high-end gigabit research networks to developing countries.

   Rationale: In North America and Europe, Internet connectivity costs under US$50 to 100 per Mbps. In Africa, current commercial prices are about US$2000 to 3000 per Mbps. The Partnership for Higher Education in Africa, a partnership of six US foundations working with seven African countries has recently committed US$200m over five year to help provide higher bandwidth at lower prices. But longer term solutions must be found. An example is the current attempt of an alliance for research and education networking[28] to purchase a stake in the Eastern Africa Submarine Cable System (EASSy) – as a partial owner, they would not be subject to Telecom company tariffs.

Recommendations 4, 5 and 6 expand the focus to institutions either not currently supported by SAREC, or those without a research orientation, but nonetheless still playing a critical role in building developing country capacity.

4. Establish a programme with the goal of providing post-secondary institutions in developing countries with the ability to create strategic policy and operating plans related to the effective use of ICTs. A potential methodology could be to run training courses teaching the Policy/Master Plan methodology successfully used in many SAREC-supported institutions, coupled with mentoring during the implementation phase[29].

   Rationale: The Policy/Master Plan methodology has proven to be a successful way to identify and prioritize needs, get constituency buy-in, and focus senior management attention on ICT issues. It is, in fact, the *process* of reaching closure that has proven critical for success. Providing the skills to allow this methodology to be used by the currently non-ICT focused post-secondary institutions would go a long way to closing the gap between them and the SAREC-supported institutions at a relatively modest cost. Information on how to write good funding proposals and what is expected in annual project reports and plans should also be included.

5. Sida and/or SAREC should be receptive to funding ICT projects in other "non-SAREC" research institutions. (See Appendix 1 for implementation notes.)

   Rationale: Although not key to the success of SAREC-funded researchers, it will significantly improve the quality of education in the country thus improving the quality of graduates who will become part of government and the local business sector, and ultimately help to address economic viability and poverty issues.

6. Sida should consider funding ICT projects in other post-secondary educational institutions, both public and potentially private. (See Appendix 1 for implementation notes.)

   Rationale: Recommendation 4 targets ICT programs in research universities – SAREC's traditional audience, if not the specific schools that SAREC has supported. This recommendation goes outside of SAREC's mandated focus to include all public and perhaps private post-secondary schools. The rationale is similar. In most developing countries, the group of people who reach post-secondary

[28] The UbuntuNet Alliance will link the developing research and education networks in Kenya, Malawi, Mozambique, Rwanda, South Africa and Uganda – http://www.ubuntunet.net/.

[29] This methodology has been pioneered by the Technical University of Delft and they may be a likely partner in such an endeavour.

schools are implicitly an elite group. The future teachers, white-collar workers in industry and government and indeed the leaders in all sectors will come from this elite group of people. It is essential that they be equipped with all of the tools necessary to succeed, and today, ICT literacy is a mandatory tool.

Recommendations 7 and 8 address ICT infrastructure project methodology, should such projects continue to be funded. Recommendation 9 addresses methodologies for developing ICT research and professional capacity.

7. SAREC needs in-house ICT experts to work with country officers to both evaluate project proposals and to monitor progress, reducing the opportunity for, and chance of, project failures. Preferred methodology would be to use people originally from the ICT4D group similar to the way that they are at times assigned to Embassies; they would officially be SAREC employees, but still with some ties to the ICT group for continuity and backup.

   Rationale: ICT is a complex speciality that most country officers have no great expertise in nor do most want to develop such expertise. Nevertheless experience over the last few years indicates that having Sida's ICT expertise residing solely outside of SAREC does not allow for a close working relationship between the ICT advisor and the country officer. By having one or more people within SAREC, the pre-2002 situation is re-established. By having the ICT personnel still affiliated with the ICT4D Secretariat, travel, vacations, leaves and career moves can be more readily covered by other ICT4D staff.

8. The requirements and responsibility of Swedish ICT project partners should be formalized and monitored with training provided if necessary. The responsibilities should be set so as to reduce the opportunity for improper or sub-optimal use of Sida funds, while at the same time moving towards the goal of having the developing country personnel be fully capable of managing their own projects. SPIDER may be a good vehicle to take responsibility for Swedish partner duties.

   Rationale: Experience with earlier SAREC projects clearly indicates that the Swedish partner's role in a project can be of crucial importance. Experience also indicates that more monitoring and control must be exercised in *some* projects than was originally planned. At the same time, these projects are of limited duration, and it is important that at the end of the project, the local project team be fully capable of managing their systems and expanding them, perhaps with the help of other donors. Without such skills, the value of the original SAREC investments will be diminished.

9. In universities judged likely to establish ongoing post-graduate programs of their own, SAREC should continue to fund doctoral ICT students according to the norms established in other academic disciplines – that is, until the academic department has the critical mass to start graduating their own students. For schools that are not at that level and where no graduate education is available locally, SAREC should continue to fund MSc and some PhD students from Computer Science and similar departments to ensure a high quality of teaching. The extent to which staff from non-academic service departments should receive SAREC-funded graduate training should be reviewed. In all cases, project and dissertation topics should generally be selected to have some relevance to the developing country. Consideration should be given to ensuring that all students have sufficient qualifications (academic and linguistic) to pursue their selected studies with the use of non-Swedish schools being considered when indicated by linguistic needs. Additional efforts should be made to ensure that students have *some* time to focus on their studies while resident in their home country.

   Rationale: Computer Science and Computer Engineering are academic disciplines whose importance to developing countries will grow. As such, SAREC should support them so that ultimately,

countries will not need to depend solely on foreign education opportunities. At the same time, academic departments that for the foreseeable future will only do undergraduate education still need sophisticated and well educated staff. ICT service departments as well benefit from staff having experienced graduate education. Until such education is available locally, SAREC should continue to provide Swedish education for a core group in each institution. In all cases, efforts should be taken to maximize the benefits from this foreign education.

Acknowledgements

The authors wish to express their gratitude to all of the people whose input made this report possible. We are particularly appreciative of the efforts of Beda Mutagahywa and Respickius Casmir from the University of Dar es Salaam and Nils Jensen from the Embassy of Sweden in Dar es Salaam. The Tanzania workshop participants from Mozambique, Rwanda, Sri Lanka, Tanzania and Uganda contributed significantly to this evaluation which would not have been nearly as focused without their help.

At Sida in Stockholm, the cooperation of Tomas Kjellqvist and Per-Einar Tröften was greatly appreciated. And this project would not have been possible without the superb coordination and support from Ulla Andrén.

The authors are also indebted to George Sadowsky for his insights during the preparation of this report.

Last, but far from least, we wish to thank Afzal Sher for his help during the preparation of this report. We, Sida, and the developing country recipients of the projects described herein owe him a debt of gratitude for designing and championing this programme.

Appendix 1. Terms of Reference

Evaluation of Sida Information Communication Technologies SUPPORT to universities

1. Evaluation purpose

The evaluation purpose is to assess the support by the Swedish Development Cooperation Agency, Department for Research, Sida/SAREC, to Information Communication Technologies, ICT, within the bilateral research cooperation.

The evaluation is commissioned in the context of an overall assessment by Sida to be carried out during 2006 of the objectives and results of SAREC research cooperation and contribution management.

The evaluation shall provide an independent view on ICT support within bilateral research cooperation to be used both as an input to the overall assessment of SAREC activities and to draw conclusions as well as give recommendations for SAREC's continued support in this field.

The focus of the evaluation should be on the impact of ICT support at universities and their research activities in particular, but also in training/education, administration and library functions. The extent to which the ICT support to universities also had an impact on the local introduction and development of Internet access, on local development of ICT skills and expertise, and on local demand for and use of on-line resources etc. should also be discussed.

2. Intervention background

SAREC has supported the strengthening of national research capacity in developing countries for 30 years. The support has primarily been given to universities with long-term scientific cooperation in partnership with Swedish institutions. The research cooperation includes both faculty based research programmes in agriculture, medicine, social sciences and technology administered at the universities, and the research supporting structures.

Sida has formulated a strategy on how the agency can promote ICT in development cooperation. SAREC regards that a sound foundation in computers and access to the Internet has become essential for modern higher education and research. Some of the first countries where Sida started supporting ICT projects on a larger scale were in Tanzania, Uganda and Sri Lanka. In addition to providing computers, infrastructure and Internet access for its research partners, these projects also upgraded facilities for the rest of the university, variously including campus networks, central ICT services, technical staff training, user training, library information systems and online research journal access, as well as ICT policy and strategic planning support. Moreover, Sida has provided specific support for university ICT training programmes including scholarships for "sandwich" Masters and Doctoral training in Sweden and occasionally in other countries. In all, Sida has supported university-based ICT endeavours in twelve countries. However, the intervention logic has varied and indicators have not always been provided

Nevertheless, SAREC's ICT support to universities can be divides into three major intervention areas, i.e. to

– enhance capabilities and effectiveness of Sida's research partners;

– enhance overall ICT capabilities of the university in research, teaching/education and administration; and

– enhance library functionality.

The evaluation shall focus on the three interventions areas during the period 2000 to 2005.

3. Stakeholder involvement

In addition to the studies made of ICT-support to Sri Lanka in 2002 and to Uganda in 2005, a study of the support to Tanzania should be made. In the case study the evaluators are expected to visit University of Dar es Salaam and meet the stakeholders within and outside the university. The evaluator is also expected to organise a small workshop to gather lessons learned from the SAREC ICT support in order to draw conclusions and come up with recommendations for SAREC's continued support in this field.

The evaluators are expected to inform the parties concerned in advance of the visit so those that want to participate in and contribute to the study can do so. The evaluator will also be expected to report and disseminate the findings to those interviewed in the course of the work or participating in the workshop.

4. Evaluation questions

Effectiveness

To what extent has the ICT support to universities achieved its objectives at project and broader levels? What are the reasons for achievement or non-achievement of objectives?

Impact

What are intended and unintended, positive and negative effects of ICT support to universities? Internet connectivity, capacity, awareness, demand and policy should be discussed. Special attention should be given to effects on research, training/education, administration and library functions, including the human resources, technical and financial aspects.

Relevance

The extent to which the ICT projects conforms to the needs of the universities and their research activities in particular, but also in training/education, administration and library functions. Is the ICT support to universities consistent with Sida policies and priorities? Is it consistent and complementary with activities supported by other donors?

Sustainability

Is the ICT support to universities sustainable with regard to capacity building and investments made in infrastructure. Are the effects of ICT capacity building, managerial and technical, satisfactory or are further capacity development needed? Have universities made available funds for operation (including cost for international connectivity), maintenance and depreciation of equipment acquired?

Efficiency

To what extent can the costs of the ICT support to universities be justified by its results? What measures have been taken during planning and implementation to ensure that resources were used efficiently?

5. Recommendations and lessons

Continued ICT support to universities

What are the lessons learned and recommendations that can be given for continued ICT support to universities? Are their alternative models for interventions that could be more efficient? Is their a need for Sida to revise its strategy on how to promote ICT support to universities?

6. Methodology

The evaluation will be largely based on the studies made of ICT-support to Sri Lanka in 2002 and to Uganda in 2005 and on a study of the support to Tanzania to be carried out by the evaluator in 2006,

but to the extent possible, will also use information on all other SAREC university ICT-support projects.

The evaluator will also organise a small workshop bringing together representatives of selected individuals from several supported universities. The workshop should draw on the active participation and input of these stakeholders.

The evaluator should use the documentation available about the ICT-projects by Sida or the institutions, project documents including project proposals, applications and progress reports as well as ICT policy, plans and other project-related documents.

The evaluator is also expected to make interviews with selected persons that are directly or indirectly involved in the ICT projects (the involved faculties/departments, libraries, the "sandwich" PhD students, counterpart universities in Sweden, selected desk officers at Sida and the Swedish Embassy), as well as have contacts with other institutions which have been involved in the projects. This may include e-mail discussions/surveys.

7. Work plan and schedule

The evaluation will take place in April/May 2006.The evaluators shall visit Tanzania, but also Sida in Sweden for interviews and will organise the mini-workshop.

8. Reporting

A draft report should be submitted electronically to Sida not later than June 12, 2006. Sida will provide comments via e-mail or telephone within 7 calendar days of receipt of the draft. The final report, not exceed 50 pages excluding annexes, shall be delivered to Sida not later than July 3, 2006. Subject to Sida's decision the report may be published and distributed within the Sida Evaluation series.

The evaluator should adhere to the terminological conventions of the OECD/DAC Glossary on Evaluation and Results-Based Management as far as possible. The evaluation report should also consider the report format presented in Annex B and a completed Sida Evaluations Data Work Sheet should be presented along with the report.

9. Evaluation team

The evaluation will be conducted by Mr Alan Greenberg and an additional co-evaluator selected jointly by Sida and Mr. Greenberg. Mr. Greenberg has extensive knowledge of all aspects of university environments and of the introduction of Internet technology into developing countries and will act as team leader.

10. Suggested list of institutions/people to meet (or communicate with by other means).

In Tanzania

UDSM Computing Center: Director Dr. Beda Mutagahywa – bmutag@udsm.ac.tz; Jabir Kuwe Bakari – kuwejb@udsm.ac.tz.

UDSM Vice Chancellor, Prof Matthew Luhanga.

The Director coordinating SAREC's overall support to UDSM.
Deans of the linkage faculties.
University Library: University librarian.
MUCHS Vice Chancellor (Muhimbili University College of Health Sciences): Prof. Kisali Pallangyo – kpallangyo@muchs.ac.tz
The ICT PhD students.
Swedish Embassy in Tanzania: Mr Nils Jensen

In Sweden

Sida/SAREC research officer for UDSM/Tanzania: Dr Cristina De Carvalho – cristina.de.carvalho@sida.se

Sida/SAREC directors: Dr Berit Olsson, Mr Tomas Kjellquist & Assoc. Prof. Hannah Akuffo – hannah.akuffo@sida.se

Sida/Department for Africa: Mrs Marianne Kronberg – marianne.kronberg@sida.se

Sida/ICT4D: Dr Anders Granlund & Dr Per Einar Tröften – per-einar.troften@sida.se

SPIDER/IT-university: Dr Afzal Sher & possibly Professor Love Ekenberg – afzal@dsv.su.se

Uppsala University: Professor Richard Wait – richard.wait@isp.uu.se

Blekinge University: Professor Lena Trojer – lena.trojer@bth.se

KTH/IMIT: Professor Björn Pehrsson – bjorn@it.kth.se

In UK

INASP: Carol Priestley – inasp@inasp.info

In Holland

Delft University: Mr Bert Geers – e.m.a.geers@ewi.tudelft.nl

Appendix 2. Post-Secondary ICT Project Expansion

If the scope of Sida/SAREC ICT university ICT projects is to be expanded as proposed in recommendations 5 and 6, the project model may have to be changed.

Sida, even in cooperation with other donors, cannot allocate sufficient resources to allow all post-secondary schools in a country to reach the ICT level of the currently funded schools. Moreover, Sida does not have the level of staff required to manage such a large number of projects. A viable alternative is to focus on a smaller number of schools and/or to limit the amount contributed to any one school, and to delegate part of the project management process.

This implies supporting ICT projects in far more organizations than currently supported by SAREC. This in turn may require a departure from the traditional SAREC bilateral agreements with universities. In its place, Sida or SAREC should consider allocating funds on a national basis, with a local agent overseeing a competitive, externally-judged process to allocate funds to individual schools, and to monitor and report results.

By using some trusted body in each country to identify those schools and projects where there are local champions and a true desire to address ICT issues, the work is taken from Sida staff and moved to people who are closer to the real issues within the country. Competitions could be run according to guidelines established by Sida. One of the challenges is to identify the "trusted body" in each country that can indeed be trusted to manage the funds properly, to run honest competitions, and to monitor progress and outcomes. In theory, it could be a government agency, or preferably some body outside of government. An NGO or some existing body with credible ties to higher education would be a good candidate. Assuming funds were available, it might be appropriate for staff from the local Embassy of Sweden to have some active involvement in the project.

The model for Swedish partners would also need to be re-examined in light of the larger number of smaller projects. It is possible that SPIDER can play a major role in supporting such projects in a beneficial and cost-effective manner. It may even make sense to look at private sector partners, similar to Nuffic's NPT program (Netherlands Programme for Institutional Strengthening of Post-secondary Education and Training Capacity – http://www.nuffic.nl/npt/).

If funding competitions are to be open to private institutions as well as publicly funded ones, consideration should be given to requiring that their grants be repaid over some period of time. Such "repayment" would not be to Sida, but rather into the country ICT fund.

Appendix 3. Abbreviations and Acronyms

Acronym / Abbreviation	Definition
ARIS	Academic Record Information System
DSV	The IT University Department of Computer and Systems Sciences
FIS	Financial Information System
ICT	Information and Communications Technology(s)
ICT4D	ICT for Development
INEC	Sida Department for Infrastructure and Economic Cooperation
LIS	Library Information System
SAREC	Sida Department for Research Cooperation
Sida	Swedish International Development Cooperation Agency
SPIDER	The Swedish Program for Information and Communication Technology in Developing Regions

Appendix 4. Interview Subjects

Sida – April 2006

Karin Afli	SAREC, Financial Officer (Burkina Faso, Ethiopia, Mozambique, Nicaragua, Rwanda, Sri Lanka)
Ulla Andrén	Department of Evaluation and Internal Audit, Evaluation Officer
Ros-Mari Bålöw	SAREC, Senior Research Officer (Sri Lanka)
Gity Behravan	SAREC, Research Advisor (Uganda, Vietnam)
Maria Teresa Bejarano	SAREC, Research Advisor (Honduras)
Rolf Carlman	INEC, Director
Zinaida Iritz	SAREC, Senior Research Officer (Mozambique)
Tomas Kjellqvist	SAREC, Director of Research Policy
Mattias Lindgren	Department of Evaluation and Internal Audit, Evaluation Officer
Inger Lundgren	SAREC, Research Advisor (Nicaragua, Rwanda)
Håkan Marstorp	SAREC, Senior Research Advisor (Ethiopia)
Berit Olsson	SAREC, Director
Per-Einar Tröften	INEC, ICT for Development Secretariat, ICT Advisor
Bertil Wahlund	SAREC, Research Advisor (Bolivia)
Sven Widerberg	SAREC, Financial Officer (Bolivia, Honduras, Laos, Tanzania, Uganda, Vietnam)

Sida – Draft Report Review – June 2006

Ulla Andrén	Department of Evaluation and Internal Audit, Evaluation Officer
Cristina de Carvalho Nicacio	SAREC, Research Advisor (Tanzania, Uganda)
Krister Eduards	Stockholm Group for Development Studies
Kwame Gbesemete	SAREC, Research Advisor (Burkina Faso)
Tomas Kjellqvist	SAREC, Director of Research Policy
Inger Lundgren	SAREC, Research Advisor (Nicaragua, Rwanda)
Håkan Marstorp	SAREC, Senior Research Advisor (Ethiopia)
Berit Olsson	SAREC, Director
Per-Einar Tröften	INEC, ICT for Development Secretariat, ICT Advisor
Bertil Wahlund	SAREC, Research Advisor (Bolivia)
Solveig Freudenthal	SAREC, Research Advisor (Vietnam)

Affiliated Organizations

Lars Asker	DSV, Associate Professor
Karoline Beronius	SPIDER, Project manager
Rudolfo Candia	DSV, Project Coordinator; SPIDER, ICT Programme Coordinator
Love Ekenberg	DSV, Professor
Lotta Rydström	SPIDER, Advisor, ICT4D
Afzal Sher	SPIDER, Director
Carol Priestley	International Network for the Availability of Scientific Publications (INASP), Director
E.M.A. (Bert) Geers	Delft University of Technology, CICAT, Project Coordinator

Workshop Participants

Americo Muchaga	Mozambique, Universidade Eduardo Mondlane, Centro de Informática , Director
Canisius Karuranga	Rwanda, National University of Rwanda, Vice Rector for Administration and Finance

Workshop Participants	
Albert Nsengiyumva	Rwanda, National University of Rwanda, ICT Infrastructure Development Team Leader
Respickius Casmir	Tanzania, University of Dar es Salaam, University Computing Centre Ltd., Quality Control & Business Development Manager
Daniel Methusela	Tanzania, University of Dar es Salaam, University Computing Centre Ltd., Research & Development Officer
Beda Mutagahywa	Tanzania, University of Dar es Salaam, University Computing Centre Ltd., Managing Director
Aloys Mvuma	Tanzania, University of Dar es Salaam, Faculty of Electrical and Computer Systems Engineering, Engineering, Telecommunications Engineering Department, Lecturer
Nerey H. Mvungi	Tanzania, University of Dar es Salaam, Faculty of Electrical and Computer Systems Engineering, Engineering, Senior Lecturer
Edephonce Nfuka	Tanzania, University of Dar es Salaam, University Computing Centre Ltd., Quality Control & Business Development Manager, University Computing Centre Ltd. Deputy Managing Director
Joseph Kimaili	Uganda, Makerere University, Directorate for ICT Support, Network Manager
Ali Ndiwalana	Uganda, Makerere University, Directorate for ICT Support
Via video conference	
Kasum De Zoysa	Sri Lanka, University of Colombo, School of Computing, Lecturer
Nimal Ratnayake	Sri Lanka, University of Peradeniya, Internet & Communication Services Unit, Director; Dept. of Electrical and Electronic Engineering, Senior Lecturer
V.K. Samaranayake	Sri Lanka, University of Colombo, School of Computing, Emeritus Professor; ICT Agency of Sri Lanka, Chairman
Ruvan Weerasinghe	Sri Lanka, University of Colombo, School of Computing, Director

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