Sida Evaluation 2008:14

Challenges when Shaping Capabilities for Research

Swedish Support to Bilateral Research Cooperation with Sri Lanka and Vietnam, 1976–2006, and a Look Ahead

Jan Annerstedt
Shantha Liyanage

Department for
Research Cooperation

Challenges when Shaping Capabilities for Research

Swedish Support to Bilateral Research Cooperation with Sri Lanka and Vietnam, 1976–2006, and a Look Ahead

Jan Annerstedt
Shantha Liyanage

Sida Evaluation 2008:14

Department for Research Cooperation

This report is part of *Sida Evaluations*, a series comprising evaluations of Swedish development assistance. Sida's other series concerned with evaluations, Sida Studies in Evaluation, concerns methodologically oriented studies commissioned by Sida. Both series are administered by the Department for Evaluation and Internal Audit, an independent department reporting directly to Sida's Board of Directors.

This publication can be downloaded/ordered from:
http://www.sida.se/publications

Authors: Jan Annerstedt, Shantha Liyanage.

Sida Evaluation 2008:14
Commissioned by Sida, Department for Research Cooperation, SAREC

Registration No.: 2006-003092
Date of Final Report: March 2008
Printed by Edita Communication, 2008
Art. no. Sida44696en
ISBN 978-91-586-8177-4
ISSN 1401—0402

SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
Address: SE-105 25 Stockholm, Sweden. Office: Valhallavägen 199, Stockholm
Telephone: +46 (0)8-698 50 00. Telefax: +46 (0)8-20 88 64
E-mail: sida@sida.se. Homepage: http://www.sida.se

Table of Contents

Executive Summary

This document reports from a study performed under the auspices of the Swedish International Development Cooperation Agency (Sida) and it's Department for Research Cooperation (SAREC). According to the Terms of Reference: "The purpose of the study is to review the development of the research systems in Sri Lanka and Vietnam from 1976 to 2006 and to assess to which extent Swedish support to research collaboration has been in line with the national efforts to strengthen the research systems."

The document contains factual overviews and a series of case studies drawn from a whole generation of collaborative projects and program experiences. The case studies are presented against a background of investments in R&D in both developing countries.

Researchers and other specialists – as well as the responsible policy-makers – confirm that Swedish financial and other support to research projects, to education and specialized training at the Master and PhD levels, and to the formation of other R&D capabilities have been significant and – in some fields of research – even critical to success.

However, the aim here is not to specify detailed outcomes of the many collaboration projects, nor to evaluate single project results, but to elaborate the challenges in all three countries, when trying to benefit more from research projects and when shaping national and local capabilities for R&D in Sri Lanka and Vietnam.

Principal lessons learned are presented in several sections of the report. Possible ways forward in the research collaboration are indicated as well. Here are some highlights:

- Fast and effective R&D capacity formation must include risk-taking that will allow limited mistakes and continuous adjustments to avoid errors. More flexibility will be needed in the design and future implementation of research projects and related innovative activities.
- Long-term perspectives and a critical mass of R&D investments are needed to address significant problems in areas such as agriculture, fishery and public health.
- Strategic partnerships: Research projects that have succeeded particularly well combine strong institutional, professional and personal linkages.
- Vague or indistinct R&D objectives make resource mobilization complicated and prevent effective coordination, quality enhancement and evaluations.
- R&D projects with an innovation edge are much-needed and could quickly trigger engagements by business firms and other private sector partners to provide more of funding. Collaborative R&D projects could accommodate commercially viable services towards end-users, e.g. in public health.
- Science-based innovation activities need to become more 'systemic' or better integrated into the wider socio-economic fabric to become more relevant and useful. More of user-centered interaction is needed for research results to be effectively exploited and new demand-led projects to be initiated.
- 'Follow-through': Some of the most successful applied research projects present a continuous stream of research results that could be used to properly address, investigate and resolve problems, provided there is consistency in the innovation approach.
- More focus could be put on innovation finance: R&D results are raw material for innovation processes but innovative activity needs to be properly funded.
- Intermediary institutions and tech-transfer units: Public-private partnerships to sustain innovation environments (such as science parks and business incubators) could become effective modes of operation to develop and sustain science-based innovation activities also in developing countries.

Copenhagen & Sydney

Jan Annerstedt & Shantha Liyanage

a. Aims and Scope of this Study

This document reports from a study performed under the auspices of the Swedish International Development Cooperation Agency (Sida) and it's Department for Research Cooperation (SAREC). According to the Terms-of-Reference: "The purpose of the study is to review the development of the research systems in Sri Lanka and Vietnam during the period from 1976 to 2006 and to assess to which extent the Swedish support to research collaboration has been in line with the national efforts to strengthen the research systems."

For Sida/SAREC, "the study will be used as a contribution to the ongoing learning process at Sida on how to strengthen systems for national research capacity and use research and development to accelerate social and economic progress." Hence, the two investigators were asked to identify past experiences and impacts of the Sida/SAREC support that could be useful for future research collaboration between Sweden and the two developing countries, irrespective of new modes of bilateral research collaboration.

While looking specifically into various science and technology development efforts, the two authors have attempted to identify significant contributions made by Sida/SAREC to the research systems in the two countries. Based on interviews and other fact-finding, the document adds insights on how Swedish support led to changes in research organization, planning and performance in Sri Lanka and Vietnam against the background of their wider economic and social transformations.

Unlike evaluations of specific projects, this long-term approach to research collaboration across continents offers a relatively extensive overview of the evolution of Swedish financial and other engagements. Such a study would have been impossible unless the investors could benefit from a wide variety of project evaluations already performed by experts assigned by Sida/SAREC since the late 1970s and from interviews with experts on research and experimental development (R&D) in the two developing countries and in Sweden.

In the three countries, the investigators have met with well over 150 professionals who have been involved in the research collaboration or monitored Sida/SAREC-sponsored projects. However, due to the limited size of this report, we can only provide summaries of the main development trends and essential highlights of 30 years of research capabilities in-the-making. More of details are provided mainly in the case study accounts (summed up in Part 4).

b. Sweden: A Pioneer in Bilateral Research Support

Already a generation ago it was expected that more of localized scientific research in the developing countries would lead to more appropriate technological and other solutions to their development problems. During the 1970s, Canada and Sweden pioneered bilateral government support by specialized agencies to research in developing countries. Canada's IDRC (International Development Research Centre) was founded in 1970 and SAREC started to operate in 1975 as the Swedish Agency for Research Cooperation with Developing Countries. In 1995, SAREC was integrated into Sida as a specialized department. Since then, SAREC's principal functions have remained in operation within Sida.

Today, "SAREC has a wide mandate in research support, encompassing natural sciences and technology, social science and humanities, natural resources and environmental protection as well as health

care. The department also contributes towards capacity building, for example through support for establishing universities and research councils in developing nations."[1]

Sida operates in so-called "partner countries" and SAREC is to fund research in partner countries and research of importance for the development of these countries. "Support is provided for research councils, universities and research institutions, for regional research networks and for international research programs. The Sida/SAREC department also supports Swedish research activities relevant to developing countries."

The principal objectives of current research cooperation, as decided by the Swedish Parliament, are to strengthen the research capacity of partner countries and to promote development-oriented research. "Strengthening research capacity encompasses support to partner countries in creating a better research environment, researcher training as well as developing methods for planning and determining research priorities."

c. One Generation of Bilateral Research Engagements

Since 1976, in Sri Lanka and Vietnam, SAREC has paid for research projects, research cooperation and related training of specialists. In addition, Sida/SAREC came to offer even more broadly based support to the formation of scientific, technological and other research-related capabilities. The construction of R&D capabilities included the procurement of scientific instruments and other advanced equipment necessary for advanced R&D, the creation of libraries and technical documentation centers, bilateral support to public policy enhancement related to R&D, higher education at the Master and PhD levels, specialized training of R&D scientists, engineers and supporting staff, and the transfer of technology and related know-how.

The first 10 years of SAREC support are characterized by support to national research councils and ministerial agencies. In Sri Lanka, the National Science Council (NSC) and the Agrarian Research and Training Institute were chosen as the main recipients of the funding who could channel these funding to research staff in universities and other public research institutions. In Vietnam the funding was channeled through the State Commission for Science and Technology (SCST), which later became the Ministry for Science, Technology and the Environment and now is the Ministry for Science and Technology.

After the first ten years of cooperation, it was evident that the two national bodies lacked some of the capabilities to organize and shape the bilateral cooperation effectively and to set priorities for research, based on scientific criteria. As a consequence, during the next period of Swedish support, starting in the mid-1980s, more efforts were made in strengthening research capabilities at the level of university departments, R&D centers and research teams, mainly by funding major R&D projects and related human resource development and by emphasizing professional research management.

Swedish counterpart institutions were involved in all major research projects. Their participation constituted a mandatory part of Swedish research collaboration in Sri Lanka and Vietnam. For example, the so-called 'Sandwich Model' for advanced training of researchers (see below for details) was introduced and made effective. The 'Sandwich Model' allows a student at the Master or PhD levels to distribute his or her time for research training and research in Sweden and the most relevant home country institution. During the time in Sweden, the student remains attached with and is able to do

[1] 1. www.sida.se (September 2007); other quotes later in this section are from the same official source.

research and related work at the home country institution The 'Sandwich Model' remains in use also for advanced training of research engineers, technicians and other supporting staff.

Over a period of 30 years, it became obvious that collaborative projects and related specialized education and training of researchers should be supplemented by broader actions. Consequently, Sida/SAREC made substantial additional investments in research infrastructures and in scientific instruments and other special equipment for R&D. Furthermore, in both countries, the Swedes have tried to meet the broader needs of scientific information through the provision of information exchange facilities, the strengthening of libraries, the creation of specialized archives and by establishing equipment repair facilities such as scientific instrument laboratories, glass blowing centers, etc.

Sida/SAREC funding has – directly and indirectly – supported a large number of research scientists and engineers and strengthened various scientific institutions in Sri Lanka and Vietnam. Swedish bilateral support was set up to contribute in selected areas to the creation and development of new research environments and in making these attractive workplaces for the researchers being trained in the bilateral cooperation programs. The local level of collaboration was to work with specialists willing to commit to scientific excellence and/or to engage in what was considered highly relevant research tasks.

As expected in any long term assistance program, the outcomes of a generation of research collaboration with the two developing countries resulted in some two hundred PhDs and many hundreds of other specialists. Moreover, the SAREC-funded projects have delivered numerous scientific and other research-related publications and may have created lasting impressions in the minds and hearts of many scientists that have participated in the projects. Unfortunately, problems have occurred due to unexpected combinations of factors such as weakness in research planning process, structural inadequacies in the national research system, lack of commitment among local partners to follow through research projects, and weak linkages between scientific research, innovation and other societal activities.

After 30 years of increasingly comprehensive research cooperation with Sri Lanka and Vietnam, the Swedish government has decided to gradually phase out the research support to these two countries. The question remains if this is the right moment in time to phase out Swedish government funding of this kind. Does 30 years of funding of bilateral research cooperation be adequate also to provide sustainable research foundations in these two developing countries?

d. Limits to This Study

As one of the deliverables from this study, this document offers assessments of principal lessons learned over the past 30 years from Swedish government support to R&D in Sri Lanka and Vietnam and for bilateral research collaboration in science and technology. However, covering a whole generation of experiences and reporting these from two countries under periods of war and peace (on some 60 pages only), is an assignment that is almost not attainable by two persons during a limited time span, even with prior knowledge of the two countries and with extensive administrative and other support.

Hence, following the scope agreed in the Terms-of-Reference, this report is a systematic attempt to assess a limited set of projects funded by the Swedes and programs of bilateral collaboration. The projects to be studies were pre-selected by Sida/SAREC (cf. the next section on 'Approach and methodology of the study'). Other investigators have already performed detailed evaluations of several of the other bilateral research projects, funded by Swedish government sources during the past 30 years. The current study has not covered in detail such a large territory of investigations, but has benefited significantly from available evaluation reports of Sida/SAREC projects completed since 1976.

Ideally, long-term experiences of research collaboration – summarized for decision-makers of today – should count high when considering new activities. Yet, and this must be underlined, the external circumstances for the development of scientific and technological capabilities in the two countries have changed radically over the past many years. These changes are reported in several sections of this document. The changing conditions for R&D activities in the two developing economies have altered the specific contexts for decision-making and limited the range of available policy alternatives.

The purpose of this study of long-term cooperation between Sweden as a donor country and Sri Lanka and Vietnam as recipients is not to give a verdict on the effectiveness of Sida/SAREC areas of funding priority, nor to evaluate the detailed outcome of the many individual projects funded through these and other Swedish government programs. Instead, this report offers overviews and provides special insights into the Swedish support to the development of the research systems in both countries. For example, we were asked to assess to which extent the Swedish support to research collaboration has been in line with the national efforts to strengthen the research systems. Sida/SAREC also wanted to learn more on "how to strengthen systems for national research capacity" and how to use research to "accelerate social and economic progress."

Given these and other boundary conditions for this study, the authors hope that the reader will find our analytical framework, and the facts and findings presented along with it, useful for strategy preparations and for more informed decision-making when implementing the next generation of Swedish support to bilateral research cooperation with Sri Lanka and Vietnam.

e. The Team, the Approach and the Methodology

The study reported in this document is a joint effort by two professors with prior proficiency in policies for R&D and innovation in developing countries and with special insights into the organization, planning and resource management related to R&D capabilities in Sri Lanka and Vietnam.

The team began its investigations by using the documentation made available by Sida/SAREC and, later, by the collaborating research organizations in Sri Lanka, Vietnam and Sweden. Interviews were conducted with current and former Sida/SAREC staff in charge of the support to the two countries since 1976. Before leaving Sweden, interviews and roundtables took place at Swedish research institutions involved in collaborative research programs in Sri Lanka and Vietnam. In the two latter countries the team paid visits to responsible government agencies, ministries, universities and other R&D centers as well as business companies.

In both developing countries our team met and interviewed researchers, R&D engineers, technicians and other support personnel; deans of faculties and heads of R&D labs; academic educators; program coordinators; project managers; librarians; representatives at national agencies; chairpersons and members of research councils; experts at ministries; business persons; and staff at the Swedish Embassies (cf. the lists of interviewees).

More specifically, in both countries, we were asked to assess the efficiency of the 'Sandwich Model' for research training and to assess the impact of the support from Sida/SAREC on the quality of the education of the students at relevant levels. Moreover, we were asked also to look into applications and solutions that have their origins in Sida/SAREC sponsored research.

Moreover, we were asked also to compare similarities and differences between Sri Lanka and Vietnam as concerns the national research policies and strategies and the research support from Sida/SAREC.

With regard to Sri Lanka our assignments included studies of the biotechnology program at the University of Colombo and the electrical engineering projects at the University of Peradeniya in terms of research capacity. With regard to Vietnam we were asked, for example, to assess the impact of the support from Sida/SAREC by two of the Health program of Hanoi Medical University and the Rural Development program at the Hué University of Agriculture and Forestry and at other universities in Vietnam.

Despite the extensive character of the assignment, the study has remained a part-time effort during 2007 and part of 2008. With the help of two research assistants in Stockholm and several in Vietnam and Sri Lanka, we have processed the documentation made available by Sida/SAREC and at the collaborating research organizations. The visits to Sri Lanka took place in January and March 2007 and the Vietnam visits followed in April and July 2007. In Sri Lanka, we conducted a survey, based on a questionnaire (cf. Appendix). It was not possible to do the same survey in Vietnam.

Acknowledgements

Members of institutions and companies in Sweden, Sri Lanka and Vietnam[2] have contributed greatly by being available for in-depth interviews, offering essential information, arranging roundtables, interviews, seminars and other meetings. We are indebted to more than 150 persons in the three countries who have spent valuable time to make this study achievable. Some persons used considerable length of time in preparing for our interviews and in discussing with us individually or at roundtables and workshops, specially organized for this study. It is our hope that the quality and relevance of the many contributions are depicted in our distillation of points made during the deliberations.

Our research assistants in Sweden, Sri Lanka and Vietnam have been a great asset to us. We are grateful for their efforts to collect information and for assisting us in completing the various tasks. We are grateful also to all Sida/SAREC staff members who have contributed intellectually, and in practical terms, while assisting us with advice and background material. [3]

[2] In particular, staff members of the University of Uppsala, KTH, Karolinska Institute in Sweden; NSF, IBMBB, the University of Colombo, the University of Peradeniya, Department of Agriculture, Rice Research and Development Institute at Batalagoda in Sri Lanka; and Ministry of Science and Technology (MOST), Hanoi, NISTPASS, Vietnam National University (Hanoi), University of Agriculture and Forestry, HCM City, Hué University of Agriculture and Forestry in Vietnam.

[3] We are indebted to our main contact persons at Sida/SAREC, Ros-Mari Bålöw and Solveig. Freudenthal, and to the research assistance by Bianka Loke and Tobias Markensten in Sweden, by I. R. de Silva in Sri Lanka and by Nguyen Thi Phuong Mai and Pham Ha in Vietnam. Extensive advice was provided by Tran Ngoc Ca, Nguyen Vo Hung, Nguyen Thanh Ha, and Vu Cao Dam. Further inspiration was provided by Geoffrey Oldham and Keith Bezanson. The responsibility for the current document and the final conclusions rests solely with the authors.

Part 1
Globalization of R&D:
New Contexts for Bilateral Research Cooperation

The most dramatic message from our interviews and roundtable deliberations in both developing countries is about the new global context for R&D (research and experimental development). One way or other, nearly every person interviewed came to mention the new setting of R&D and innovation, given the fact that both Sri Lanka and Vietnam have been converted into open economies, increasingly dependent on world markets.

Sri Lanka and Vietnam are both becoming fully integrated into the regional and world economies and are facing strong international competition related to their knowledge-based economies. Sri Lanka continues to face additional difficulties due to a serious internal political-military conflict, while Vietnam has emerged from two wars (in Cambodia and with China) during the period of Swedish R&D engagements.

Today, decision-makers in both countries have to be much more sensitive and responsive to global economic, political and other changes than just a generation ago. This means that the local and national contexts in fostering innovation for business and for other purposes have changed radically. The globalization of the economies of Sri Lanka and Vietnam has influenced also the conditions for funding and performing R&D.

In these new contexts, the interviews performed point at six closely related or overlapping features of science, technology and innovation, currently recognized as critical for policy-making related to international research cooperation and R&D investments.

1. A more Knowledge-based Economy

Increasingly, in both Sri Lanka and Vietnam, far-reaching changes seem to occur in the role of science and technology throughout the economy and in the wider society. Easy access to scientific expertise and to related technological capabilities is perceived as essential for innovation to take place and for new service provisions to companies and to citizens. Scientific advances and technological and other innovations are seen by some of the persons interviewed as essential to international competitiveness. Yet, both countries have been relatively slow in creating functional linkages between R&D and other socio-economic activities.

Challenging reference points for a more knowledge-based economy are found just across their national borders: The new science-based industries in India and China are recognized both as threats and as models for attaining high-tech development in Sri Lanka and Vietnam for the purpose of economic growth and international competitiveness.

2. The Changing Science and Technology Divide

India as a neighbor to Sri Lanka and China as a neighbor to Vietnam are becoming full-size, globally-oriented investors in R&D. China's current gross national expenditures on R&D are second only to those of the USA. This massive expansion of R&D is contributing to an increasing knowledge divide regionally as well as globally. Unless Vietnam and Sri Lanka will increase and/or specialize spending on R&D and related innovation, both countries will face more of high-tech competition in their regions.

During the past few years, emphasis in this cross-border competition has been put also on the efficiency in diffusion of already available technology and related knowledge and know-how as well as on related skill formation among R&D scientists and engineers and other specialists. For example, some multinational corporations, and other foreign direct investors, look for easy access to universities and other science and technology institutions in Vietnam. Science parks and other intermediary institutions are set to create new innovation environments and stimulate risk-taking, while fostering better applications of science and technology.

Vietnam is currently competing actively with China and India for high-tech foreign direct investments in its two metropolitan areas, attracting companies like Intel, the world's biggest semiconductor company, which in March 2007 started construction on its US$1 billion chip assembly and testing facility in the Saigon High-Tech Park. Intel is expanding also in China, but has found alternative investment opportunities in Vietnam, triggered by Vietnamese support to its high-tech infrastructure.

3. Market Forces as Drivers of R&D

The increasingly systemic character of innovation in manufacturing and in various service domains has triggered a re-thinking of the linear approach to innovation, where science is providing the push towards new applications and. thereby, stimulates innovation. Instead, we have noted in both Sri Lanka and Vietnam that market forces are recognized as influencing priorities and becoming drivers of R&D investments. This implies a series of policy challenges to be addressed with reference also to the globalization of R&D. For example, funding of R&D from a variety of sources, including foreign-owned companies, is already being encouraged by way of new public policy initiatives. End-user perspectives cannot be ignored when selecting among investments in R&D and while setting national and sectoral priorities for R&D.

4. The Loss of Specialists from the R&D Institutions

Two principal types of 'brain drain' were noted during our country fact-finding. (a) Researchers and other specialists engaged in R&D are being lost to other sectors of society, since the local conditions for R&D and related innovation are not considered appropriate at all times. Mobility across sectors increases along with the globalization of the labor market for highly-skilled, specialized persons.
(b) Talents are being lost to other countries with large R&D investments in the region and overseas. Mobility across national borders is an increasingly important feature of globalization, stimulated even further by the progressively more open economies of both Vietnam and Sri Lanka.

However, in Vietnam, we were told during the interviews, most Swedish-trained researchers remain in their home country (but some in other job functions than research). Some of the talents lost to other countries have come back to Vietnam, at least under temporary schemes for returning professionals.

In Sri Lanka, the situation seems different even if only scanty evidence on employment status of graduates is available. The "tracer study", recently conducted by the National Science Foundation of Sri Lanka, suggests that the conditions for employment of graduates have not changed dramatically for the period of 1999–2005 (See Table 5). Currently, there is an exodus of trained scientists from Sri Lanka to other countries. Very little effort is made by government to retain the graduates and attract trained local staff. Indeed, the "tracer study" revealed that graduates who have returned home found that employment opportunities in their own area of expertise were restricted, especially in the biotechnology field.

5. Changes in the Performance and Management of R&D

Along with their integration into the global economy, the leading R&D institutions in both countries have become more professionalized. It seems that international examples and, more specifically, Swedish support to the management of projects and of institutions have had an impact on the R&D managers involved in cooperation projects. We found that the majority of institutions visited are managed according to efficient methods for academic leadership.

In broader economic and management terms, the linkages between R&D and innovation cannot be considered effective, especially compared to Sweden and other industrialized countries. There is lack of appropriate combinations of policies for science, technology and the economy and a generally weak entrepreneurial spirit among researchers. The management capabilities to govern the R&D systems of Sri Lanka and Vietnam towards industrial growth and socio-economic development remain weak. Consequently, there are fundamental deficiencies in value creation from research results to invention and innovation.

Increasingly, the importance of building innovation capabilities has been recognized in Vietnam. This is reflected also in strong efforts to commercialize research results. Research institutions are becoming involved in the creation of new ventures and other entrepreneurial activities. Less so in Sri Lanka, where the science and technology base and infrastructure remain modeled after the British R&D system. Deficiencies in integration of R&D with innovation represent a serious functional weakness in both countries. Until now, despite statements by policy makers, the local and national R&D activities and results are seldom appreciated as useful raw material for innovation. Science as a professional activity is not integrated with the rest of the economy to a degree that corresponds to what is currently being achieved in the EU countries.

6. Intercultural Learning

Intercultural learning comprises practical applications of knowledge about various cultures and social practices such as learning to engage and negotiate with people from different cultures. In this sense, culture is an instrument for communicative action and a guide to interpret different social contexts.

Constructing research capabilities may require new aspects of intercultural learning, where researchers from Sri Lanka and Vietnam could better design, develop and carry out collaborative research to an international standard within the context of different cultural contexts. Although there is evidence that intercultural learning has taken place in some specialized research communities in the two countries, such as in the life sciences and biotechnology, we have not encountered particular policy initiatives aimed at strengthening collaborative means and communicative mechanisms related to the culture of research communities that operate across the national borders and across continents.

Today, all six features of science, technology and innovation in an increasingly global context are considered important, even of critical importance, when constructing and implementing national, regional and local public policies and strategies for R&D. The features just listed – more and more influenced by globalization – should be taken into consideration also when Swedish support to bilateral research cooperation with Sri Lanka and Vietnam is up for revision.

Part 2
Research Cooperation with Sri Lanka and Vietnam: General Lessons

While the process of globalization of research, science and technology has shaped a radically different context for Swedish research cooperation with Sri Lanka and Vietnam of today and in the coming years, what general lessons could be learned from the past and put to use as bilateral cooperation continues? How to benefit more from the impact of the efforts made over thirty years to strengthen the bonds between the donor country in Europe's North and the two recipient countries? Which priorities when constructing new scientific and technological capabilities in Sri Lanka and Vietnam using Swedish support?

In this report, we are summarizing both general and piecemeal evidence to answer these and similar questions to help advance decision-making. Before these summaries are presented, we would like to underline the following main lessons:

(a) Research Capacity Building remains Critically Important

Through our interviews and other fact-finding it became clear that indigenous capacity building related to research and experimental development – funded and otherwise supported by the Swedes at least since the mid-1980s – has been highly instrumental for carrying out advanced R&D in a range of fields. Human resource capacity building in the form of training was given strong emphasis in knowledge transfer and there was no evidence of post doctoral training and relationship building that is essential for high level of knowledge transfer and intercultural learning. Among the specialists interviewed in both countries, there is a strong consensus that human resource development and scientific and other research activity has helped create and generally promote in-country technological capabilities and lay a more solid foundation for science-based innovation. Many examples were mentioned to us to illustrate this point and some of these are depicted in the text below.

Furthermore, Sida/SAREC-supported researchers and other R&D specialists in both countries have undertaken research projects that have promoted research capabilities that will last far beyond the time of the projects. Research capacity formation is a complex process where the research environment may have to be developed simultaneously. Sida/SAREC attempted this at different times with assistance to spare part purchases, modernization of research laboratories and the provision of specialized equipment. However these attempts in the severely under-funded R&D system in both countries were both incremental and relatively small scale.

(b) …but Research-based Innovation Activities Need to be Energized

Already from the mid-1970s, the Swedish support to scientific research in Sri Lanka and Vietnam was expected to speed up the process for indigenous innovative activity and to find solutions that would adapt to national priorities, respond to sectoral and local demands, and fit changes in the socio-economic context. But capacities for indigenous research will not become effective tools for wider socio-economic change unless the R&D results are turned into new products and processes.

To become part of demand-led value streams, scientific knowledge and related know-how need to be diffused effectively and used as raw material for economic and other action. Our interviews and local fact-finding indicate that the bridges between science, the economy and the rest of society are not wide enough, nor operating effectively, compared with corresponding bridges among the highly-industrial-

ized countries. In Sri Lanka, as in Vietnam, much more needs to be done in order to make research results useful and easily available and to create more of functional interactions between science and society. In both countries, commercial and other private-sector involvement in the funding and exploration of R&D is very limited.

(c) Private Sector Engagement in R&D and Innovation

Generally, in both countries, the private sector is the most economically dynamic sector compared to the public sector. Yet, both countries have a history of a public sector-dominated economy. Despite examples of local and foreign business enterprises that have taken initiatives to develop original science-based solutions, the number of companies engaging and exploiting R&D for innovation remains low in both countries. Yet, we were offered examples that more and more of linkages are being established to make better use of high technology that stems from the R&D institutions.

Consultancy agreements between researchers and other R&D specialists in Vietnamese institutions and business firms are one such type of examples. Although roughly of the same age, the private sector in Sri Lanka is smaller than in Vietnam, and most companies remain government-owned or under government control. We were told that there were strings of initiatives taken to link better the Sida/SAREC-funded research to business development, e.g. by specialized training schemes for researchers. We were offered an example of a training course by Vinnova of Sweden that would help transfer Swedish and Nordic experiences in shaping science and technology parks and other intermediary institutions to specialists in R&D in Sri Lanka.

From one of the roundtables in Vietnam, there was a general request to engage also Swedish high-tech companies – and not only Swedish universities and other institutions – in new forms of strategic R&D collaboration – for the purpose of R&D capacity building and in fostering innovation in Vietnam by way of knowledge production, new business ventures and the shaping of innovation environments, including science and technology park investments.

(d) Mutual Interests as the Principal Driver in Bilateral Collaboration

More than 30 years after the beginning of Swedish research collaboration, we receive clear messages that time seems more ripe than before that both Sri Lanka and Vietnam for research collaboration based more on mutual interests across the continents, where individual researchers, laboratories, university departments and other R&D institutions and business firms are the real drivers of collaboration. For example, the collegial relationships developed during the past ten years or more between professors and other researchers at the universities of Colombo and Uppsala have reached a stage where there are strong mutual interests at the levels of departments and research units to conduct mutually reinforcing research tasks either jointly or in other forms of team-to-team collaboration. Similarly, Karolinska is currently fostering long-term twinning arrangements between researchers in Hanoi and Stockholm by opening a liaison and project office in Hanoi.

These examples and others from elsewhere are signs of maturity in professional relations that will assure that mutual interest is the principal driver of R&D collaboration, not a simple donor-recipient relationship. Moreover, in interviews and during lab visits in Stockholm and Uppsala, we found specific examples of research advancements that were not feasible without collaboration with colleagues in Sri Lanka and Vietnam. As both developing countries are enhancing their R&D capabilities and expanding their activities, there should be many more such bilateral opportunities, where mutual interests could foster more functional collaboration to the benefit of all involved.

The good-will attained by a generation of Swedish support to science and technology and the many years of one-to-one R&D collaboration has created high-quality platforms for more collegial relationships.

(e) Sida/SAREC Encountering New Partners

While Sweden was pioneering research for development 30 years ago, Sida/SAREC is now one of many public and private organizations from several continents that pay for substantive research projects in developing countries. Sweden is by no means alone in assisting R&D capability formation in these countries. Governments like those of the United Kingdom, USA, the Netherlands, France and now even China have government-funded programs to support large research projects and related R&D capacity formation in developing countries. Rockefeller, Ford and Gates foundations are among resourceful private interest groups that support R&D for development, even paying for whole universities and major R&D labs connected through global networks.

In a situation with more sources of funds, and more needs to be addressed, the donor countries will have to make their actions more harmonized, transparent and collectively effective. This is the spirit of the 2005 "Paris Declaration on Aid Effectiveness", an attempt also to resolve partnership commitments that cause overlaps among donors and prevent aid effectiveness. Sweden has supported actions based on the Paris Declaration, which will allow developing countries to exercise effective leadership over their development policies, strategies and to coordinate development actions. Time seems ripe for such coordination also in Sri Lanka and Vietnam, where Swedish experiences will be constructive for the new donor partners, who might look to Sida/SAREC for leadership in a process aimed at managing resources more effectively. In Sri Lanka as well as Vietnam, some of the experiences gained during 30 years of Swedish collaboration are appropriate for establishing a more inventive partnership with commitments and engagements at the level of research groups, R&D centers and academic departments.

Here, it could be mentioned that Sida/SAREC has been able to help foster in both Sri Lanka and Vietnam more of an international scientific culture, influenced by professional approaches to R&D and innovation activities. Sida/SAREC support may have been looked upon as more neutral and with fewer strings attached compared to the engagement by some other donor countries.

(f) …while Swedish Self-interests to be Reflected in R&D Related to Innovation

At the same time, as multilateral aid priorities and cross-country coordination could lead to more effectiveness in the use of available resources, we find that the diffusion of R&D results needs to be improved also for commercial purposes. In both Sri Lanka and Vietnam, we were presented with cases where the R&D results and related know-how were not transferred to productive usage. For example, Swedish high-tech companies in the energy sector did not take the opportunity to exploit science-based results accomplished by Swedish-funded R&D in Sri Lanka; nor did any other company benefit. Vietnamese geotechnical expertise, trained to the highest academic level in Sweden, was not hired by Swedish companies but by other foreign companies in competition with the Swedish private-sector counterparts. In several of the interviews, the lack of effective commercial exploitation was highlighted as a deficiency in Swedish aid programs.

How could the six general lessons from the past – from (a) to (f) – be put to use while the bilateral research cooperation is set to continue between Sweden and Sri Lanka and Vietnam? We have noted that professional bonds between Sweden and the two countries remain strong at the level of research institutions and academic departments. We found a lot of examples where research groups continued to cooperate even after the Sida/SAREC project funding has come to an end.

If these observations are correct, how could other potential stakeholders become involved and benefit from a generation of R&D collaboration to make it useful also for innovation? How to benefit more from the impact of the efforts made over a period of thirty years and how to strengthen the functional linkages between the two recipient countries and the donor country in Europe's North?

Part 3
Shaping R&D Capabilities with Swedish Support: Country Pictures

To address these and similar questions, we will be summarizing below both general and specific evidence of how the two countries have succeeded in using Swedish support to construct R&D capabilities and conduct projects of research and experimental development.

The efforts to develop and sustain research competencies in these countries have been arduous and challenging. In the course of the past 30 years, we have seen shifts in the orientation and overall emphasis of the research programs funded by Sida/SAREC. For example, more projects do accommodate multidisciplinary approaches and more efficient forms of conducting and managing research projects have been applied. We are offering two broad country pictures with a view on

A. The Swedish impact on the principal actors of the two R&D systems,

B. How Swedish support to R&D made a difference,

C. How Sweden have influenced R&D management, strategy, and policy, and

D. The Swedish impact on the utilization of R&D results.

In Part 3.1, we begin by focusing on R&D in Sri Lanka, followed by a similar review of R&D in Vietnam, summarized in Part 3.2.

Part 3.1 Sri Lanka's Benefits from Sida/SAREC Support

Sri Lanka, with a landmass of 66 square kilometers, has a population of 19.6 million (according to 2005 census), majority being Sinhalese, followed by Tamil, Muslim and Burgher communities with Sinhalese and Tamil as official languages. English language is widely used, an, inheritance from colonial times of the British rule which lasted over a century until independence in 1948. The literacy level recorded 92% in 2003.

Agriculture has been the major source of income with the exports industry sector driven by three major plantation crops- tea, rubber and coconut, and semi-skilled manufactured products.

The governments have invested heavily on education which is free up to the university level and most Sri Lankan's regard education as an important investment for personal development and self reliance. Since independence in 1948, investment in science and technology has not been a high priority agenda of most incumbent governments. The renaissance of science development was regarded in 1950s to early 1980s with peace and harmony in all ethnic groups which was shattered since the raging civil war in 1983. Since then, conducting science, technology and development work was arrested and restrained by misguided priorities and lack of a scientific culture.

According to the most recent survey of R&D expenditure in Sri Lanka, the Gross National Expenditure on R&D (GERD) is 0.22 percent of GDP. Historical trends show that GERD has gradually increased from 0.13 percent of GDP in 1985 to 0.18 percent in 1996 (See Table 2 and Table 3 for details of the national R&D expenditure). The number of scientists per million inhabitants in Sri Lanka was 237, which is low compared with the average of the developing countries (374 per million populations). However, according to UNESCO estimates, it is still higher than India (112), South Africa (192) and Other Asia (100)(NSF 2006). The current research system in Sri Lanka was supported mainly by public sector funding while private sector involvement in research and technology development is negligible

(see Table 4). Scientific capability development in Sri Lanka can be studied in two distinct periods; period between 1947–1983; and the period from 1983 onwards.

Principal Actors in Sri Lanka's R&D System, 1940s–mid 1980s

Sri Lanka's research system was emulated on a British colonial system and it was structured to service the plantation crops that benefited British interests. The crop research system still remains as a viable research system and it was structured according to the collection of cess or a levy on export or import of commodities. It was expected that this cess was to be utilized for research purposes. As a result, private industries expected a service from the public sector research institutions, a research culture still prevalent in Sri Lanka.

The key players of the national research system can be categorized into four major groupings:

1. Policy making institutions (e.g. the National Science Council) and science associations (e.g. Associations for Science, Engineering and other professional groups)
2. Government Departments and Statutory Bodies (Department of Agriculture, Department of Forestry, Department of Irrigation, Department of Health, Department of Fisheries, National Engineering Research and Development Center, Industrial Development Board etc.)
3. Research Institutes (Tea Research Institute, Rubber Research Institute, Coconut Research Institute, Ceylon Institute for Scientific and Industrial Research)
4. The Higher Education Sector which comprised of universities and technical colleges.

Until the mid-1980s, the research structure in Sri Lanka was primarily organized to support the agricultural economy. The national research efforts were organized to support staple crops such as rice and export crops in the plantation industries including Tea, Rubber and Coconut. Applied research was organized according to needs of plantation crops. The Tea Research Institute (TRI), Coconut Research Institute (CRI), Rubber Research Institute (RRI), and the Department of Agriculture with its extensive network of agricultural research stations and extension services were the oldest institutions related to the agriculture and plantation industry sector. These elite research institutions were modeled on the British system and the research was usually selected by the scientists and the application of research was conducted by the extension services. The long standing tradition of focusing on a single crop had entrenched in localized research culture that responds to incremental changes. Such an approach had a limited international impact other than servicing the plantation crop economy.[4]

The public sector research institutions were under the control of the key government departments and line ministries such as the Ministries of Agriculture, Fisheries and Forestry, Ministry of Industry, Ministry of Plantations and the Ministry of Education.

Industrial research, the weakest link in the national system, did not improve much over time and was primarily conducted by the Industrial Technology Institute (the former Ceylon Institute for Scientific and Industrial Research – CISIR). Industrial research was confined to a small number of research actors, the Ceylon Institute for Scientific and Industrial Research (CISIR established in 1955– renamed as Industrial Technology Institute – ITI in 1998, repealing CISIR Act no 30 of 1984), followed by the National Engineering Research and Development Centre (NERD established in 1974) and Industrial Development Board (IDB established in 1969). Industrial and scientific research was organized to support the development of industries. However, most industries under the public domain had limited impact on research endeavors of these institutions and their primary clients were the public sector institutions (Table 4).

The private sector research is negligible with the notable exception in natural product chemistry where

[4] According to one science commentator, the research of crops institutions were glorification of the past without any future aspirations with the talents they possessed.

the exports of essential oils and perfumery industry have several private sector industry research performers.

During the 1960s and early 1980s, the national government established several other research institutions including the National Aquatic Resources Agency (NARA), Building Research Institute (BRI), the Central Environmental Authority (CEA), and the Agrarian Research and Training Institute (ARTI) for social science research in agriculture. These institutions were largely service institutions with the exception of NARA with a limited research budget and limited impact on science system.

The research funding system was centralized with the Treasury of the Ministry of Finance allocating a budget for each of these institutions when the yearly estimates were forwarded. There was a marginal increase to budgets each financial year and often this did not even account for the inflation or fluctuation of foreign exchange. All public research institutions were set up under the Act of Parliament, therefore dismantling or reorganizing these institutions was a near impossibility.

Traditionally, the universities were the major source of basic research. Fundamental research was further augmented during the last two decades with the establishment of the Institute of Fundamental Studies (IFS), first in Colombo in 1983, and subsequently moving its headquarters to Kandy. Universities have contributed to research strengths in several fields such as biotechnology, medical sciences, agriculture and marine sciences. One of the vital areas of research was the medical research, which was largely conducted by medical colleges in Universities and a single research institutions known as the Medical Research Institute (MRI), which was established in 1901 by the British Government. With the exception of WHO assistance, medical research was mainly funded from the Government sources. There was no medical research council or research granting body for supporting medical sciences and the National Science Council provided limited support to medical research. Engineering research in Universities is confined to few research actors.

Science policy movement was active for quite sometime. In the early 1960s, Sri Lankan scientists lobbied for the establishment of a national body to coordinate and promote scientific research activities in the country. In response, the government established the National Science Council in 1969, which primarily had the jurisdiction of supporting research in the higher education sector and largely areas other than agricultural research. Agricultural research was in the jurisdiction of the well established Ministry of Agriculture which had a net work of research organizations. Ironically all research in the plantation crops were under the jurisdiction of the Ministry of Plantation Crops. Invariably there was no coordination or the sense of working towards a common national research agenda. In an attempt to organize research in Agriculture, the Council for Agricultural Research Policy (CARP) was set up in 1987 to coordinate agriculture research.

During 1960s to late 1980s, the development of the national research system was closely followed by inward looking export substitution policies adopted by successive Governments. The emphasis was largely on agriculture development with limited interest in the development of industrial enterprises. In fact, most of the industries were state owned and the outward looking policies to attract Foreign Direct Investments (FDI) were largely to provide tax incentives for large corporations' employment of semi skilled workers for some manufactured products under the free-trade zone agreements. The capacity to develop research was not in the agenda and the research linkages between private and public sector institutions were weak.

At the time of commencement of Sida/SAREC support to Sri Lanka around 1976, research was confined largely to selected research institutions and state run universities. As a result, the Universities and the institutions belonging to the agriculture sector were the major recipients of Swedish development assistance through 1970s to 1980s.

Principal Actors in Sri Lanka's R&D System, 1980s–2006

During this period, some of the notable additions to the research actors were the environmental research centres, information technology research institutions, biotechnology research groups and more science policy making bodies such as National Science and Technology Commission (NASTEC), National Research Council (NRC) and the establishment of a separate Ministry for Science. The proliferation of research institutions continued at the expense of strengthening and restructuring the existing ones.

Conducting research became extremely difficult due to civil unrest started in 1983. These unsettled conditions led to prolonged closure of universities and research institutions. The power supply, access to research material, constant interruption due to civil calamities and the inability to source resources led to the slow down of research activities. In some cases, it was impossible to run experiments and maintain research material and equipment. Most researchers had to work under trying conditions (Karunanayake 2006). It was difficult to maintain research faculties due to constant disruption to power supplies, high taxes, and access to facilities due to the curfew, exodus of trained manpower, procuring spare parts, equipment and material. However, many scientists, both recipients of Sida/SAREC grants as well as others braved the situation to maintain research work even in the remote and relatively inaccessible parts of the country such as the Northern Province in Sri Lanka.

Gender imbalance was noted in both employment of female scientists and the female graduates passing out from the university science streams. About one third of fulltime employed scientists was female graduate. The university output of female graduates was also low (Hettiarachchi, Dilrukshi et al. 2005).

We have also noted a low level of female graduates in science and technology management positions. Since the 1980s, there has been a shift towards an industrial economy with export orientation and the research institutions were encouraged to address research with applied problems (Wickremasinghe and Krishna 2006).

Sida/SAREC support to industrial research was notably low with the exception of support to Information Technology projects. It has been suggested that Sida/SAREC support to information technology development was a major boost to Sri Lanka's computing and information sciences. The Council for Information Technology (CINTEC) was responsible for organizing the ITC policy and capacity building with the assistance of the IT industry. CINTEC was made a statutory body with Parliamentary Act No.10 of 1984. Another notable addition to scientific institutions was the Arthur C Clark Institute of Modern Technologies (ACCIMT). It was set up to accelerate the introduction of modern technologies to Sri Lanka.

Most of these research agencies depend on public funding for research and local agencies such as the National Science Foundation (NSF) and the recently established National Research Council (NRC) for funding individual researchers through contract research projects.

In summary, the science and capability development efforts were skewed by a strong focus on sectoral development priorities rather than national research competencies. Many research institutions and scientific organizations continued to operate as typical state run institutions with limited research outcomes and with limited consideration for research performance and public accountability. Political priority for scientific research was low, although some Governments have attempted to raise the research quantum by establishing an important office such as the Science Advisor to the President.

A limited effort has been made to steer the research system using Sida/SAREC funding, hence the impact of Swedish funding was localized and was limited to select areas of science and a few groups of researchers (Sanderathe and Nilsson 1996). Despite the prevailing civil war, limited political support and an inefficient public service, individual researchers have made valiant efforts to support the evolution of the research system. We found evidence of excellent research conducted by individual research-

ers who were cash strapped to continue the good work initiated with Sida/SAREC funding. There were isolated individual and groups of scientists who seemed unwilling to work together in an individual culture of research performance and were competing for meager resources.

Swedish Influence on the Management of R&D in Sri Lanka

Project selection and the direction of research funding: Swedish assistance to science and technology activity in Sri Lanka was channeled mainly through the National Science Council (NSC). As early as 1976, SAREC awarded grants to the NSC and the Agrarian Research and Training Institute (ARTI). NSC received SEK 800,000 and ARTI received SEK 1.2 million as initial grants for the purpose of financing imports of scientific equipment and related documentation. The Swedish grants also aimed at scholarships and study visits by specialists to overseas organizations, on scientific exchange, and research cooperation with other countries. The project selection at early stages was carried out with SAREC officials working with Sri Lankan scientists (Thornstrom 1989).

Early in the process of collaboration with the Swedes, the newly established NSC was motivated to assist many university researchers. In 1979, NSC received a further SEK 1.4 million for financing of imports of equipment and for training of research personnel. All research agreements however had to be channeled through the Department of External Resources of the Ministry of Planning and Plan Implementation.

Typically, NSC grants were awarded to individual scientists employed by research institutes and universities. Projects for Swedish funding were selected on the basis of calls for applications (Pethiyagoda 2006).

The selection of Sida/SAREC research projects in the early days was largely based on funding criteria adopted by the local institutions. The National Science Council had a system of research project selection which was followed through a call for research applications, research project selection through various Research Committees of the Council and the approval of the project by the Board of the Council. Some of the Sida/SAREC grants were also decided on the basis of direct negotiation with individual researchers and research institutions. The Sida/SAREC project officer was responsible in the formulation of the proposal in consultation with local and Swedish partners.

The research projects funded by the Swedes were usually well structured according to the broader national priorities and exigencies. For example, the Buffalo Research Project was initiated at the time of the fuel crises in the 1970s and 1980s (NARESA 1997). Subsequently, the project received Sida/SAREC funds for ten years with an integrated approach to the management of the health of the animal and its social use (e.g. through the Buffalo Information Centre at the Head Office of the Department of Animal Production and Health). Sida/SAREC provided extensive support during two phases, which amounted to about US$ 1 million with 69 research projects conducted with participation of over 125 scientists. The scale and duration of this project was significant as it has assisted research capacity building in several institutions and agencies. This was one of the complex research programs that involved several executing agencies and was managed by the National Science Council with clear scientific and technological inputs and outcomes.

The system of research in Sri Lanka was cultivated through two tiered systems, which were not necessarily closely integrated.

- Efforts to reorganize and direct research through policy processes attempted by various ministries (such as the Department of Agriculture, Council for Agricultural Research Policy, Ministry of Industries).
- Efforts by specialized agencies such as NSC and research institutions to fund weak areas of research in the country.

Some of the key Sida/SAREC funded research programs were: The water buffalo research; the fresh water fisheries; the molecular biotechnology and gene technology; the biological and ecological coastal marine sciences; the biochemical pest control; the renewable energy and energy efficiency; the electrical engineering project at the Peradeniya University; the computerized scientific and information technology project; the IT and internet development; the library support, and the scientific infrastructure project. Some of these projects have yielded significant scientific benefits (Dayaratne 1997). Besides these projects and programs, there were also extensive support to travel grants, specialized workshops and conferences, information systems development and purchase of chemicals and major equipment, including the purchase of a mass spectrophotometer for the Ceylon Institute of Scientific and Industrial Research (CISIR). Biotechnology has been a major focus of the Government, which had been also a focus of development assistance (NSF 2004).

Sri Lanka: The University System

At the time of independence in 1948, Sri Lanka had only two major universities: The University of Colombo and the University of Peradeniya. The number of universities has increased dramatically during the last two decades, and currently, there are 13 universities operating in the country (see Table 1). The universities formed the strongest link of the research chain in Sri Lanka with a talent pool of the country's best trained scientists, engineers and medical personnel. The setting up of new universities to appease the voters in every province of the country by successive governments has done very little to consolidate and strengthen the existing research capability. It has indeed eroded the already depleted trained senior academics by further distributing them across newly formed and relatively ill-equipped universities (Greenberg and Sadowsky 2002).

All universities are publicly funded and the education is provided free. The University Grants Commission (UGC 1978) makes provisions for universities to engage in research, research training and education. Research in universities was mostly funded by external grants with very limited allocation of internal resources to research. Even at the time of this study, some of the leading universities such as University of Peradeniya has just begun to strengthen its research management system and has appointed an Academic Director for research. The University has also incorporated research commercialization as a strategy in the future plans of the University.

Sida/SAREC's support to University research has been steadfast and funds were channeled through the National Science Foundation and subsequently through the University Grants Commission (UGC). Sida-SAREC's support has mainly gone to biotechnology, biochemistry, fisheries and marine biology, agricultural sciences, electrical engineering, information and technology development fields, library and modernization of research facilities and equipment grants.

Although universities are expected to provide leadership in new knowledge creation in cooperation with other research institutions, there is very little evidence of inter-institutional collaborations. This is partly due to the heavy focus on teaching and the fact that most research is generated as a result of research by individual researchers. Even the major projects funded by Sida/SAREC such as the Electronic and Electrical Engineering Project, several biotechnology projects in the university sector have struggled to generate stronger collaborative links (apart from personal collaboration) with other institutions.

The research culture is heavily influenced by academia and was fostered by individual research agenda. There was no evidence of research management apparatus, research commercialization outfits and research centers with applied focus. Such initiatives are beginning to take shape in some of the progressive universities such as Moratuwa University, Peradeniya University and some Departments such as Computer Science Department at the University of Colombo where efforts of entrepreneurial research were made.

Our visit to a select number of universities and research institutions revealed that most research laboratories were ill-equipped and had outdated equipment and facilities. Only a few research faculties with external assistance had the latest equipment, for example The Institute of Biochemistry, Molecular Biology and Biotechnology (IBMBB). The University system was based on the traditional model of revenue dependence from the state with very limited capacity to generate its own funds. Only a handful of postgraduate courses such as business management and biotechnology are allowed to charge tuition fees.

In addition to low level of funding, relatively lower salaries, insufficient support funds, difficulties in procurement of research equipment and consumables, high degree of bureaucracy and procedures to purchase consumables and equipment, weaknesses in supply chain and excessive reporting and evaluating procedures have all contributed to low research productivity in the university's research environment. The universities were also saddled with the perennial problem of student unrests that were culminated due to political activities. There was a lack of appreciation for intellectual, learning or scholarly culture among the students and the expectation was that those who passed the university education must be employed by the state. Despite these setbacks, the universities of Sri Lanka have maintained the standard of teaching and research and have emerged as major performers of research with significant research output in the country. Sida/SAREC projects in particular were instrumental in some of the most vibrant research projects completed in the university system. Without Sida/SAREC support, many university researchers were unable to train doctoral students who worked as research assistants for projects.

Sri Lanka: Recent Science and Technology Development Initiatives

The most significant recent change in Government responses to development of science and taking responsibility of building scientific capability is reflected in a Presidential policy document known as "Mahinda Chintana: Vision for a New Sri Lanka (2007)". A ten year development framework, 2006–2016 identified science and technology as a key to economic development and it recognized the following key issues: weak scientific infrastructure, low investment in scientific research; inadequate S&T personnel; isolation from main stream research; lack of a science culture; lack of initiatives to retain and support innovative people; lack of entrepreneurship and entrepreneurial leadership; inadequacy of indigenous technology development; lack of political will to promote science and technology; lack of interest in students to pursue science and science education.

Several measures and key interventions, including the establishment of the National Research Council which provides significant competitive grants to local researchers have been initiated. However these policy interventions need to be backed up with real financial resources as well as reorganizing the ailing science system.

Initiatives to spawn new scientific fields and programs, and create new institutions when old institutions were underperforming or to gain political advantage in Sri Lanka have not been in short supply. Recently, an entrepreneurial group of scientists lobbied for the establishment of Sri Lanka Institute of Nanotechnology which was recognized as a key intervention of the policy document "Mahinda Chintana". It is estimated that about six hundred million rupees (some SEK 37 million) will be required to establish such a centre when only about sixteen Sri Lankan scientists from various sectors are involved in nanotechnology. In June 2007, the Minister of Science allocated 5 billion rupees to implement a nanotechnology program.

Sida/SAREC supported the establishment of a major infrastructure development project in medical biotechnology at the University of Colombo, the Institute of Biochemistry, Molecular Biology and Biotechnology (IBMBB). The construction and actual operations of such institutions, along with effective R&D programs, require consistent and long-term support. The inability of researchers to

make their presence known and generate an impact through scientific advances has been widely debated and there has been wide criticism on the effectiveness of the Ministry of Science. The Government in response to such criticism has now adopted thematic research that will address research needs of a wider cluster of research problems such as fuel and alternative energy sources. The implementation rests with the overburdened research institutions that are starved for funding due to proliferation of research groups.

Did Swedish Support to R&D in Sri Lanka Make a Difference?

During the thirty years of development assistance to Sri Lanka, Sida/SAREC has had to deal with a range of organizations, an uncertain political climate and inconsistent policies and different personalities in building science and technology capabilities. Some of the interventions such as focusing on development priority, selection of research projects to achieve desired benefits have yielded positive impacts. Without Swedish support some of the research programs such as Buffalo research or biotechnology and genetic research would not have been established and strengthened for a foreseeable future. Indeed the most critical support was given through training and capability building which was fundamentally the core of Sida/SAREC assistance. These initiatives were extremely beneficial and have developed strong links and cultural ties between Sweden and Sri Lanka. Swedish research cooperation has had a considerable influence of shaping the research agenda from highly academic to a more pragmatic research system. Swedish assistance has made the following impressions on the Sri Lankan research system:

- Strengthening Areas of Research Excellence and Teams in Specific Fields: 30 years of funding over long periods of time had major impacts on building the key capability and capacity in selected research areas.
- Building Decision Making Capability: Sida/SAREC influenced the policy making, research management practices in the country. Both by direct involvement of SAREC project officers and continuous reshaping of research project selection and management processes, making judgments on the effectiveness and governance of the research system in the country, Sida programs contributed to significant advances in scientific knowledge in areas such as natural product chemistry, agriculture and marine biotechnology and biomedical research.
- Building Human Resource Capability: Sida/SAREC program has had an influential impact on building human resources by direct individual training and building curriculum and postgraduate training which has had significant impacts on building a future skilled work force. Such assistance had the direct impact on strengthening the research investigating capacity and research culture.
- Building Research Networking Capacity: Sida/SAREC assistance had major impacts on the creation and strengthening of local and international networks of research. Building research networks is vital to share knowledge and generate new intellectual capital and in essence is part and parcel of science and technology capability building.
- Instilling Research Accountability and Research Methods: Research accountability and employing research methodology have significantly improved with adoption of institutional mechanisms to monitor, evaluate and account research funds and improve research practices. These practices, however although have not been extended to capture benefits of research and commercialize research outputs. Nevertheless it had contributed to better practices and awareness in research accountability.
- Improving Institutional Responsibility: Sida/SAREC support over a long period of time had initiated institutional reformation and cost-effective ways of managing and supporting bilateral research collaborations, especially emulating a research culture responsive to engage in international science.

- Changing Research Practices: Sida/SAREC programs involved some of the renowned research institutions in the World such as Karolinska institute which was able to influence the transition to 'best practices' of conducting research. Local scientists had to adopt to the new 'research culture'. This can be regarded as one of the most enduring changes that influenced the research system in the country. The importance of publishing in international journals were instilled in research culture where most researchers were protected within a thin veil of importance of publishing in local sources where results of research is not subjected to international scrutiny.
- Developing of new topics of research investigations: Sida/SAREC assistance had contributed to vital areas of research that was not attempted before. Investigation into tropical diseases by Swedish and local researchers in vital areas of research was possible due to long-term and open ended support from Sida/SAREC. Some of this research found wider international applications.
- Supporting diffusion of results of R&D: Sida/SAREC had limited focus and interest in diffusion of research results. The major focus of research programs was the increasing stock of knowledge and change in research environment and human resource development. There was no extensive support to industrial research or business research. Indirect benefits can be seen as spillover effects from the research conducted in public research institutions in some areas such as natural product chemistry. Heavy focus on university sector was one of the reasons for playing down the importance of diffusion of research which must be redressed. This can be considered as a major weakness of the Sida/SAREC approach to R&D capability building.

Part 3.2 Vietnam's Benefits from Sida/SAREC Support

Vietnam has a total land area of 325 000 sq km, neighboring Cambodia, Laos and China. The climate is tropical in the south and monsoonal in north with a hot, rainy season and a warm, dry season. The population in 2007 is more than 85 million with two metropolitan centers: Hanoi/Haiphong in the Red River Delta in the North of Vietnam and Ho Chi Minh City (Saigon) in the South of the country. More than a quarter of the population is younger than 15 years. Vietnam has a labor force that is growing by more than one million persons every year. The median age is now 26.4 years. Current life expectancy at birth is 71 years. GDP per capital is US$ 3,100 (2006 est.).

After the end of the war of unification in 1975 considerable efforts were made during a decade in integrating the North and the South of the country into one market. In the same time period, the government experimented with a planned economy. Bold economic reforms ('Doi Moi') started in 1986, followed by a step-wise opening of the borders for international trade and investments. Since then, relatively fast economic growth rates were achieved (until 1997), while reducing poverty in the rural areas. Average annual GDP growth rates were 9% between 1993 and 1997.

The 1997 Asian financial crisis led to a slowdown of growth in Vietnam and a rethinking of the economic development model followed by the introduction of new structural reforms. For example, Vietnam has tightened monetary and fiscal policies to stem high inflation. Yet, GDP growth averaged 6.8% per year in 1997–2004, which was higher than in several of the other members of the ASEAN Free Trade Area (AFTA). Growth rates hit 8% in 2005 and 7.8% in 2006.

Vietnam joined the WTO in January 2007, following a period of adaptations to the global trade regime.

Agriculture's share of economic output (GDP) has continued to shrink, from about 25% in 2000 to 20% in 2006. Yet, agriculture's share of the Vietnamese labor force remains (in 2005) relatively high (57%), while industry (37%) and services (6%) are relatively low. Industry represents some 42% of GDP and services 28% (2006).

Vietnam: The Principal Actors in the R&D System

The Swedish government began its support to bilateral research cooperation with Vietnam in 1976, the year after the war of unification of the North and the South Vietnam had ended. The groundwork for the Swedish support was laid during a time when Vietnamese public policies were under influence by the USSR. This influence was significant also on Vietnam's organization of scientific and technological research, its methods for R&D funding and the general management of research labs and other institutions performing R&D. The Soviet influence on government policies would diminish over time, particularly after 1986, when Vietnam entered a phase of step-by-step reforms and renewal ('Doi Moi') and began the road to a modern market economy, later to become integrated into global trade and investment regimes (the 'Open Door' policy).

Before 1975, all major R&D institutions were organized according to government sectors as defined by the line ministries. Most of North Vietnam's ministries benefited from their own R&D labs, when wanting to use results from science and technology. Universities, if at all operating during the war periods, focused their activities on higher education and training and did not perform much of R&D.

Thirty years later, public R&D organizations are still the dominant actors in Vietnam; while the number of R&D organizations has increased dramatically, especially during the last ten years. In 1985, R&D was performed within a little more than 100 R&D institutions. In 2006, there were at least 1200 institutions and other organizations involved in R&D. However, not many of these are to be found in the business enterprise sector, whether in private or in publicly-owned companies. Business enterprise funding and performance of R&D remains extremely weak in Vietnam also compared with the other economies of Southeast Asia. Only during the last ten years, firms have invested in R&D; most of these are state-owned firms. The current Government offers co-funding to business firms investing in R&D.

Principal Actors in Vietnam's R&D System 1976–1986

During the first period after the war (1976–1986), some enforcement was made of the *sectoral R&D organizations* located under the line ministries. When the war had ended, there were only a dozen such R&D organizations in the North of Vietnam. Soon after, when the North and the South of Vietnam were being unified under Northern leadership, a number of other such ministerial R&D units were formed to provide R&D for the government sectors.

At the same time, in 1975/76, several *national centers for research* were established to resemble the Academies of Sciences in the USSR and the Eastern European countries. They were first called academies, but later restructured and named National Centers. Especially two of them grew while developing a number of specialized research units. The National Center for Natural Science and Technology remains until this day the largest and maintains sizeable institutions such as the Institute of Physics, which gained a prominent scientific standing early in the history of modern Vietnamese science. The Institute of Information Technology, under the same National Center, is another example of a successful R&D institution, operating according to international standards even when computers and communications equipment were not the latest available.

Nonetheless, the national centers started to function effectively across the board only in the early 1980s, even if they, in some cases, took over full responsibilities from already operating ministerial R&D units. During this post-war period, the *universities* remained dedicated to education and training for basic academic degrees. According to this research policy model, which separated research and higher education, the national centers for R&D were asked to provide the universities with trained researchers and other expertise to teach according research-based curricula. With a few exceptions, Vietnam's universities did not educate PhDs and otherwise train researchers. Typically, PhD training was done in other countries or by specialized institutes under the national centers for research.

During the first post-war period, while the South and North of Vietnam were being unified, *business enterprise R&D* was either non-existent or relatively insignificant. Few companies, not even among the large state-owned enterprises, invested in R&D, new prototypes and engineering design. Those who actually invested in R&D for new products and processes engaged in very small projects only.

Principal Actors in Vietnam's R&D System 1986–1996

Along with the economic reforms, first initiated in 1986, the *universities* of Vietnam obtained the rights from government to engage in research and experimental development (R&D). However, in practice, research functions at universities did not become effective until the late 1980s. And, it would take another ten years – until the late 1990s – when a clear majority of Vietnam's universities could claim to be research-performing institutions, thereby able to play a part in the national R&D accomplishments and to cooperate with their peers internationally. In retrospect, the process of the functional upgrading of the universities in Vietnam has been slow.

In the beginning of Vietnam's economic reform process, most universities operated under the Ministry of Education. Ten years later, a number of them had moved their primary affiliation and come under direct influence of a sector ministry. For example, the agricultural universities were linked to the Ministry of Agriculture, while the Schools of Architecture were connected to the Ministry of Construction. Until today, the system of sector-specific universities and colleges is maintained.

In this period, as before the economic reforms were started, the ministries kept their own *specialized R&D institutions,* although some of these sector-labs diminished in size and limited their performance of R&D. While the Ministry of Education remained responsible for examination procedures, etc., the sector ministries maintained considerable influence, for example on appointments of key staff such as the president of a university or specialized university college.

Agriculture is the sector in Vietnam that brings together the highest number of sector-specific R&D organizations, including its own universities. In this period and until today, these primary-sector R&D organizations are gathered under the Ministry of Agriculture and Rural Development. Major research areas, since the mid-1980s, are related to husbandry; crops, vegetables and fruit; plants for industrial processing (coffee, tea, rubber), forestry plants, and water resources.

Since the mid-1980s, the Ministry of Health has many research labs and related organizations within its sector domain. Furthermore, under the Ministry of Science and Technology, there remain a number of relatively large organizations conducting basic researches, but some of their research activity has been transferred to the universities.

Over many years, the Sida/SAREC support to Vietnamese R&D capacity building was focused on, but not limited to agriculture/forestry and health.

In this second post-war period, 1986–1996, the funding of the handful of *national centers for R&D* continued to grow. Some of their specialized institutions, e.g. for information technology, became national nodes in R&D within their fields of specialization. They also became important for the implementation of the government's R&D policies, since the universities remained relatively weak as research institutions. In 1993, there was a restructuring of the national centers to make their operations more aligned with the reforms of the economy and the growth of the universities as R&D institutions.

Business enterprise R&D started to grow during this period, but remained relatively unimportant compared to other R&D investments in Vietnam. Actually, in this period, a number of R&D organizations were established under large state-owned enterprises, but several of them failed to accomplish their goals of performance. However, even small and medium-sized companies in areas like consumer and industrial electronics, food processing and electro-mechanical engineering began developing new products and processes, while engaging researchers and other academically-trained experts. Yet, until

the mid-1990s, it is fair to say that Vietnam did not achieve any significant science-based industrial ventures, except as a result of some *foreign direct investments,* all with minor of R&D activities in Vietnam.

To enhance quality according to international academic standards, a few universities (such as the Vietnam National Universities in Hanoi and in HCM City) were formally operating directly under the Prime Minister's office. Their presidents maintained the rank of vice ministers with political responsibilities for their institutions. Other universities, such as the Polytechnic University in Hanoi, had special relations to the Ministry of Education, which opens for a relative autonomy in their current and future operations as scientific institutions.

Foreign direct investments in higher education were launched in small scale in the mid-1980s, but significant investments began only about ten years later.[5] Now, there are at least two Vietnamese-funded private university projects in the making.

Principal Actors in Vietnam's R&D System 1996–2006

Measured by research investments and by changes in the organization of research, the *university* system in Vietnam has changed slowly, yet radically, during the past twenty years. Still, compared to other countries, university research in Vietnam remains weak. In 2006, "only a limited number of university faculties have adequate resources for significant R&D. The research infrastructure is below international standards, and what research is being carried out tends to be theoretical, supply-driven, and not connected to the needs of the productive sector."[6]

For the past ten years, it should be underlined that the infrastructure and general facilities of the university system of Vietnam have been upgraded significantly. According to NISTPASS some university laboratories have reached the regional standards. The system of electronic libraries and internet-based communications has been strengthened. Yet, actual expenditure on R&D at universities is only about 4% of the gross national expenditure on science and technology research. Interestingly, while the government pays half of the universities' R&D activities, business enterprises pay a growing share of academic R&D; still only half, however, than what comes from international R&D funding sources such as Sida/SAREC.

In this period Vietnam has 93 universities and 137 university colleges (2005). Some are grouped into regional universities. A number of colleges contain specialized academies (e.g. for finance, banking, etc.), which are dedicated to professional training under the auspices of industrial, economic or professional associations. In 2007 the universities in Vietnam are estimated to consume 5–6 per cent of the gross national expenditures on R&D.

Radical steps to enhance university-based research are envisaged for the period 2006–2010. It is a general perception among the decision-makers that we met for interviews, that Vietnam's academic research institutions are not meeting the demands caused by the high rates of economic growth. At a policy meeting in 2006 with some of Vietnam's principal experts, gathered at HCM City's University of Economics, Dr. Nguyen Quoc Te summarized the socio-economic contributions of research in Viet Nam, indicating that there is room for improvement. He also indicated that Vietnamese research also lacked the competitive edge necessary for international integration.

Although the Ministry of Education and Training has regulated the time to be used by the university lecturers (e.g. by requesting them to spend 30 per cent of their time on scientific research), many lecturers remain overloaded with teaching tasks and have limited time to conduct scientific research.

[5] One major investment has been made by Australia's RMIT, which has built an academic facility in HCM City and is currently planning another one in Hanoi.

[6] Tran Ngoc Ca: *Universities as Drivers of the Urban Economies in Asia: The Case of Vietnam*, Washington DC: The World Bank (Development Research Group), Policy Research Working Paper 3949, June 2006, p. 6.

Moreover, the ministry has requested that all universities in Vietnam should obtain at least 15 per cent of their annual revenue from capitalizing on their own scientific research. During the next five years, this share should increase to 25 per cent. The Ministry of Education and Training asks them to commercialize their technological advancements by 2015.

While the universities in Vietnam slowly are becoming more prominent in R&D, the period from the mid-1990s until today has meant a small, relative decline of the R&D investments by the *national centers for R&D*. Taken together as a group, their role in the overall national R&D effort peaked during the first part of the 1990s, while the universities continued to grow slowly in importance for research in science and technology. In 2004, the centers were re-organized and re-named academies. Like the two National Universities, the two most prominent national centers[7] were placed directly under the Prime Minister's office in order to operate more independently under their own R&D mandates. Still, the universities are the current growth poles in Vietnamese R&D investments, although the current growth rate is only slightly above the national average of growth in gross expenditures of R&D.

During the past ten years, some R&D institutes, which were established under the large state-owned enterprises, have been detached from these and brought to the relevant line ministries to create larger units with wider mandates for R&D for sector-specific R&D.[8] Even if significant examples could be found of *business enterprise* investment in R&D already by the mid-1980s, the overall growth of business enterprise R&D during the past ten years was meager, except when foreign direct investors have included R&D or advanced services related to R&D in their investments.[9]

On the other hand, many initiatives have been taken during the past twenty years, especially during the past ten years, to develop and maintain better functional linkages between science and the economy. R&D is to be brought closer to business although the models being tried have been short-term and difficult to implement in Vietnam. The economic and other effectiveness of the many initiatives is being debated continuously among policy-makers and business persons.

In the recent past, the most spectacular investments by the Vietnamese government (national and regional) have been so-called high-tech parks (Hoa Lac High-Tech Park outside Hanoi and Saigon High-Tech Park in HCM City). Both parks include advanced infrastructure and other investments in the order of USD 100 million. In Vietnam, there are now a dozen high-tech zones in the two metropolitan areas and in some other regions.

Yet, a summary made already six years ago remains correct, according to our recent observations: The national R&D efforts are still "organized, financed and managed in such a way that technology transfer is difficult and expensive."[10] Science-based innovation is a very recent phenomenon in Vietnam.

Did Swedish Support to R&D in Vietnam Make a Difference?

In the 1970s, Sweden was one of the first western countries to provide a counter-balance to the then dominant research policy regime in Vietnam inspired by USSR and Eastern Europe. Financially, in this early period, the Swedish contributions to funding were marginal, but funds became available with relatively few strings attached. As importantly, the R&D institutions of Vietnam had relatively little funding at their disposal and the Swedish financial support meant a big different to the resource base for the departments, centers and other organizations at the receiving end.

[7] The names (as of 2004) are Vietnam Academy of Science and Technology, and Vietnam Academy of Social Sciences.
[8] For example, the Tea Research Institute under the Vinatea Company is now placed under the Ministry of Agriculture and Rural Development. So is the Institute of Vegetables and Fruit (previously with a major state-owned enterprise).
[9] Such as the Hanoi International Technology Center (HITC) by the Schmidt Group.
[10] Bezanson, Keith, et al: A Science, Technology and Industry Strategy for Vietnam, Hanoi: UNDP/UNIDO, 2000.

The additional funding from the Swedes was used not only for operating much-wanted R&D projects in relatively large scale. It was used also for, e.g., international travels by policy-planners and senior policy-makers. Especially from the mid-1980s – once a more comprehensive Swedish support scheme to the enhancement of R&D capabilities in Vietnam was implemented with emphasis on human resource development – seminars and workshops, and a variety of training opportunities in Europe provided new experiences, practical reference points and fresh sources of inspiration from other countries than those dominated by the USSR.

In particular, a number of department heads, deans of faculties and other leaders of Vietnamese universities and specialized R&D institutions under the line ministries became motivated to work differently, e.g. in a more decentralized, project-based collaborative mode, while cutting across disciplinary and administrative barriers to achieve new scientific and technological results. This was underlined in interviews and at a roundtable with Sida/SAREC-funded project officers.

These changes did not happen over night. As already indicated, Vietnam's universities came to acquire the organizational, technical and human resource capabilities to perform advanced research (according to international standards) only slowly. However, as underlined during our fact-finding in Vietnam, many of the principal changes in recent years of R&D-organization and -management were developed through Masters-, PhD- and other post-graduate training schemes, often with Swedish and other Nordic reference material and role models, as well as through other bilateral or multilateral collaboration schemes, funded by SAREC.

Financially, during the second part of the 1980s and until today, Sida/SAREC has remained a relatively small contributor to the overall funding of R&D in Vietnam. However, it was noted in several of our interviews that the Swedish impact in some of priority areas for research – such as agriculture/husbandry, forestry and health – has been significant and much larger than the actual size of funding. Since Swedish funding has been adapted to Vietnamese Government priorities, as part of the bilateral negotiations for each new funding period, it seems – at least in retrospect – that these priorities were enforced.

During the past two decades, new science and technology research practices and policy references have not only been provided by Swedish government intermediation, but by the Canadians, the Dutch and other government-funded programs for collaboration with Vietnam in science, technology and other areas of research. However, Swedish official support to R&D (mainly, but not only through SAREC) was available relatively early and was considered more adaptable to the changing needs of the relevant Vietnamese institutions, including the universities. This flexibility and compliance with the on-going and, from time to time, dramatic policy changes became useful also for the government's decision-makers.

For example, at a decisive stage in the overall reform process, the Swedes provided essential funding and other support to a whole series of Vietnamese workshops, policy reviews, international study visits, expert training and informal deliberations. These activities were managed by CIEM (the Central Institute of Economic Management) in cooperation with other government agencies and international organizations.

Since then, CIEM, NISTPASS (the National Institute for Science and Technology Policy and Strategy) and other specialized agencies have been engaged in policy studies related to science, technology and innovation in line with the overall policy reforms and as part of the preparations for Vietnam's full entry in the World Trade Organization (WTO). These studies included analyses of 'market demands' for science and technology across economic sectors,[11] development and protection of intellectual property, and the management of intangible assets and capabilities in business firms and in the public sector.

[11] CIEM/NISTPASS: "Technological innovation of the industrial firms in Vietnam", UNDP (Project VIE/01/025).

Directly and indirectly, Sida/SAREC support – in combination with other Swedish Government support – is seen as instrumental by the Vietnamese interviewed in assisting researchers and other experts to develop good professional practices to attain high-quality results and in fostering more of socio-economic relevance of the research activities.

Swedish Influence on the Management of R&D in Vietnam

During the more than 30 years of Swedish-Vietnamese cooperation in research, the general modes of operation, especially in priority-setting and the management of R&D, has changed dramatically. Even if the Swedes soon took a relatively active involvement in Vietnamese professional deliberations on the management of science and technology, it is difficult to assess the actual impact by the cooperation between the two countries on the speed in the reforms of R&D management and organization under the ministries and at the universities. Some Vietnamese experts interviewed claim that the SAREC set early examples by their effective project organization, which were quickly transformed into Vietnamese practices on a larger scale in the line ministries involved. Other persons interviewed said that these reforms would have happened anyway, but that the Swedes might have influenced the speed of some required reforms.

From Institutional R&D Funding to Program and Project Funding

At the beginning of the Vietnamese 'Doi Moi' reform process (1986), the Government ministries and agencies allocated general R&D funds to institutions assigned to perform specialized R&D. During 1978–1985, there were some 76 priority R&D programs set up to solve particular issues and more than a thousand R&D projects conducted. However, the ways and means by which these projects were managed had little to do with effective project- and program-oriented R&D funding. In general terms, the execution and actual performance of R&D were sector-defined and often highly compartmentalized within the sector with little cooperation, if any, with the other sectors' research organizations.

Five years later into the economic reform process – at the beginning of the 1990s – an estimated 25–30 per cent of R&D funding had become project-based. Priority programs for R&D had been created, each combining state-funded R&D projects and each oriented towards the reforms of the economy. These programs had been launched as part of a new policy for science, technology and innovation. Each priority program was addressing particular needs as defined by government. The needs were defined as national, sectoral (ministerial) or local. For the first time, a number of R&D projects was conducted by industry sector.

By the mid-1990s about half of the government R&D funds went directly to programs and projects rather than through the general funding of R&D institutions, centers and labs. A typical government R&D program, such as the R&D program related to shipbuilding, could include some 10–20 research projects, each with a project manager and a team of researchers. Expertise for the execution of such a program were brought together from a variety of areas, thereby creating more of multi-disciplinary teams than before to become involved in R&D activities.

In several steps, during the 1990s, the number of high priority R&D programs was reduced and made more forward-looking towards inventive and effective development of new applications of digital information technology, biotechnology, and technologies linked to energy produce and distribution, new materials, maritime resources, agriculture, forestry and health care. In 2001, the Prime Minister approved 10 national R&D priority programs plus several national social scientific research programs.

The stepwise transformation from institutional R&D funding with broad ambitions to program and project funding with much more of operational objectives implied a need for a more professional management of R&D. In this process of change, the Swedish emphasis on R&D capacity building and advanced training of researchers, research engineers and technicians, library specialists and others was timely and seen as effective.

A number of such R&D program specialists and project managers had been trained within Sida/SAREC projects and via educational efforts performed in Sweden and elsewhere. This training was both theoretical and practical in orientation. One of our Vietnamese interview persons tells us that by having been submerged into a project-driven R&D environment, the Swedes provided new management skills in real time that the Vietnamese could transfer quickly and effectively into the changing R&D and innovation contexts of the 1980s and 1990s. We encountered several such examples of effective socialization of researchers, thereby attaining highly-specialized, professional skills simply by deep engagements in collaborative projects with Sida/SAREC funding. However, we do not have enough evidence to conclude that these success stories are typical features in Swedish-Vietnamese research collaboration.

Vietnam: Swedish Influence on Strategic Plans and Policies for R&D

Following the economic reforms initiated in 1986, the past 20 years of policy changes related to R&D and innovation in Vietnam have been considerable. Taken together, the changes in the overall organization for R&D, in methods for R&D priority setting and budgeting of programs, and in the general management of R&D are far-reaching. For these changes, Vietnam has sought ideas, methods and procedures from many country sources.

Yet, there has been a notable Swedish impact – mainly through training of Vietnamese policy planners and experts, study visits and consultancy services. There was a Swedish influence also on the preparations for elements in planning and on the overall policy framework, while under preparations. After the beginning of the economic reform process in 1986 and the implementation of 'Doi Moi' and the 'Open Door' policy for Vietnam's R&D capacity building, Sida/SAREC has been instrumental in assisting the Vietnamese government to develop the methods and mechanisms for strategic plans and related policies for research, science and technology. These bilateral efforts have been focused on the national as well as on the sectoral line ministerial levels.

This kind of Swedish support was channeled to policy analysts and advisors under the State Commission for Science and Technology (later to become the Ministry for Science, Technology and the Environment; now called Ministry of Science and Technology). For example, parallel to training of some of its academic staff, the Institute of Science Management (ISM) received Sida/SAREC project support focused on new legislation and new procedures and practices by government agencies to shape more effective R&D organizations and to promote the professional management of R&D, the transfer of technology and related know-how across sectors and national borders, etc.

The impact on the national policies and on policy implementation by these Sida/SAREC projects cannot be overestimated, several of the persons interviewed claimed. Had the Swedish policy support been limited to R&D projects, the impact would have been much less. Since the support to policy enhancement and to R&D programs with a variety of research projects continued year after year, with an increasing variety of support measures, including specialized staff training at the Master and PhD levels, ISM came to serve as a 'think tank' for policy development and change nearly to the same extent and in the same degree as CIEM did for the broader economic and administrative reforms in Vietnam.

After ISM merged with NISTPASS (the National Institute for Science and Technology Policy and Strategy), Sida/SAREC support to policy studies and strategy development related to R&D and innovation has continued. Hence, the Swedes have actually provided input and wider support to policy and strategy development over several decades. From the mid-1980s, like the USSR in the 1970s, Sweden became an early reference point for policy development and policy implementation.

It should be underlined that similar policy and strategy support, as Sida/SAREC provided, also came from other donor organizations such as CIDA/IDRC of Canada, JICA of Japan, etc. These bilateral

support schemes were much more limited in time and scope and perhaps therefore considered less significant compared to Swedish long-term support. UNIDO, UNDP, WHO and the World Bank have also provided source material and conducted special studies that have assisted Vietnamese experts in developing science, technology and innovation policies at the national and sectoral levels. With regard to policies and strategy development, some coordination was made between the various bilateral support programs and between the bilateral and multilateral programs.

Vietnam: Swedish Influence on the Utilization of R&D Results

The emphasis in Sweden's funding of research and of bilateral research cooperation with Vietnam has been more on the construction of R&D capability than on the commercial and other exploitation of R&D results.

In very simplified terms, Sida/SAREC's support to Vietnamese R&D institutions could be described as a supply-side strategy leading to investments in human resources and the construction of R&D capabilities, rather than a demand-led strategy, primarily designed to exploit R&D results. In practice, however, there is often little or no contradiction between supply-side and demand-led approaches, since both approaches ultimately aim at the full utilization of new knowledge in the economy and throughout society.

It must be underlined that, when providing Swedish funds for helping to construct R&D capabilities, the socio-economic context for the expected utilization of end-results were always mentioned and taken into consideration. According to our source material from Vietnam, and drawing from the interviews conducted there, no question marks were put forward regarding the relevance and potential usability of the Swedish support to R&D capability creation and development.

In broad terms, based on our interviews in Vietnam, the Swedish investments in the creation of R&D capabilities and in R&D projects have all been considered relevant to the official socio-economic aims for the relevant sector. In most cases under scrutiny in our study, it seems that the Swedes have been fully aligning themselves with the Vietnamese Government's socio-economic development plans, even when not agreeing with everything in these plans. In some cases – when the cooperation plans and projects were discussed prior to reaching agreements between the two parties – the Swedes have tried to push the issues in the direction of more bold reforms.

Informal influence by the Swedes for making the utilization of R&D results more effective has been exercised at several levels. Here, an example only at the level of project design and management:

Prior to Swedish R&D support to Vietnam's agricultural advances, the approach to R&D and experimental farming in Vietnam was relatively centralized and conducted in a top-down manner, according to one interviewee. Typically, a research institute and one or several experimental farms worked together in a relatively closed circuit. When the Swedes entered to fund and train researchers at the departments of the agriculture universities, they put emphasis on pilot activities and experimental farming directly engaging individual farmers or groups of farmers. The Swedish-Vietnamese research teams involved the farmers as end-users of R&D from the very beginning of the R&D process, even during the design phase of the project.

We were told in interviews that the approach directly involving end-users has changed the blueprints for several R&D projects in this part of the economy, forced the application of interactive research methodologies, and created more effective communications between researchers, other specialists and the farming community throughout the process of research and experimental development. In particular geographic areas and sectors of agriculture, it has also led to a faster and more efficient use of R&D results. We were also told in interviews that the user-engagement in these projects have led to less of

compartmentalization of research and more of multi-disciplinary approaches, involving also a broad range of expertise.

Similar examples of new approaches, initiated by the Swedes through research training, in reference projects and by role models, can be found in areas of health research, environmental research, urban planning research, etc.

For example, Swedish Government support with some multilateral aid to the creation and implementation of the Vietnamese national Information Technology (IT) Program in the beginning of the 1990s was considerable. Here, the main issues for support were not R&D capacity building but the utilization of R&D results, training of policy specialists and of trainers, and the diffusion of experiences from across the world, particularly from Sweden (and from Denmark and Finland). The expert knowledge needed to foster the implementation of the national IT program, including the internet infrastructure, domain names services, etc. was supported by a range of Swedish experts. In parallel, important support was provided also for the use of IT and related communications technology in Sida/SAREC-funded R&D projects. Particular support was given to the use of IT in library and documentation services.

The impact by these particular actions for the early utilization of R&D results related to IT can hardly be overestimated, we were told. At the same time, we were given examples that some of the services related to digital and other documentation infrastructure and related library functions (e.g. for the large data base on patents established by the Swedes) were too centralized, too complicated to use and too expensive for the ordinary R&D lab or research unit to really be beneficial. Here, it seems, the organizational and technological infrastructure was not entirely adapted to the context of Vietnamese R&D and innovation at its current stage of development.

Part 4
Sida/SAREC's Role in Constructing R&D Capabilities: Case Studies

To deepen and qualify insights into the major issues of research collaboration between Sweden and the two developing countries, we were asked to conduct detailed case studies during 30 years, selected by Sida/SAREC. These case studies were designed to address also Swedish support to the construction of R&D capabilities.

At the level of projects and groups of projects, the results of our case studies are summarized in Part 4.1 on Sri Lanka and in Part 4.2. on Vietnam. The case studies have been based on primary and secondary data gathered and processed by the two investigators in Sweden, Sri Lanka and Vietnam. We received extensive help also from our research assistants and from resource persons in the three countries. Much of the inputs was received in oral form (such as personal interviews, thematic discussions with specialists, roundtable meetings, etc.). In the case of Sri Lanka, we also organized a survey. These facts and findings were combined with analyses of reports and policy documents, and evaluations of selected projects, scientific journals, newspapers and magazines and other documents.

Part 4.1 Research and the Construction of R&D Capabilities: Evidence from Sri Lanka

In addition to our general assessment of the impact in Sri Lanka of Swedish support to the construction of R&D capabilities and for research cooperation, two areas were selected by Sida/SAREC for detailed reviews of individual projects. This part of our report contains a summary of the two main cases plus some of the additional general information and judgments registered during interviews and in other source material, including elements from surveys and data analysis. The two cases are the biotechnology program of the Institute of Biochemistry, Molecular Biology and Biotechnology at Colombo University and the electrical engineering projects at the Electrical and Electronics Engineering department at the University of Peradeniya. More specifically, we were asked to assess the impact of the support from Sida/SAREC on these programs at the two universities in terms of research capacity at both individual and institutional level, capacity to secure funds from other sources, capacity to manage research funds, etc.

Similarly, at the Swedish universities collaborating with Sri Lanka, we were asked to look into the impact of support from Sida/SAREC in terms of research capacity, internationalization of research and on research competence of special relevance for developing countries;

Case: The Institute of Biochemistry, Molecular Biology and Biotechnology

In Sri Lanka, the Institute of Biochemistry, Molecular Biology and Biotechnology (IBMBB) is perhaps the most impressive biotechnology research facility available. The Institute conducts biomedical research and teaches postgraduate training courses in the field of biotechnology and provides a formidable infrastructure for serious research and education of students. The vision of the Institute is to foster a conducive culture for research in molecular life sciences and high quality human resource development to facilitate national development.

IBMBB, ceremonially opened in April 2004,[12] was largely funded by the Swedish research cooperation under the institutional development program. The institute received a soft loan of SEK 15 million from Sida/SAREC as an expansion activity of capacity building in biotechnology. The institute developed

[12] By the then Swedish Ambassador in Sri Lanka and Prof. Ulf Pettersson, Vice-Rector, University of Uppsala, Sweden.

largely due to the efforts of a few individuals who devoted much of their time and energy to establish the institute, which took nearly 25 years since the early 1980s. The initial design was funded by the Asian Development Bank's Science and Technology Personnel Development project.

Today, IBMBB is an independent institution with a Board of Management, headed by the Director. The institute houses some of the most modern equipment and research facilities in biotechnology research. The laboratory complex with a floor area of approximately 27,000 sq.ft. spread over two wings, each with four floors is located in the main campus of the University of Colombo.

The idea was mooted via early contacts with Sida/SAREC funded research with some senior scientists who were involved in collaborative research. The Department of Biochemistry at the Faculty of Medicine at Colombo University was an early recipient of financial support from what was once known as International Seminars in Physics and Chemistry (ISPC) for developing countries. The formulation of projects was left to the personal initiatives and contacts. Sida/SAREC provided financial support to the ISP program from 1978/79.

The research work on diabetes and asthma carried out by the Department of Biochemistry at the University of Colombo contributed towards increasing the visibility of the research group and strengthen collaboration with the Swedish counterparts. Several other developments also contributed to earn a research reputation with Dutch grants in 1981 to investigate the effects of Sri Lankan dietary habits on the pharmoco-kinetics of anti epileptic drugs and this project was successfully completed in 1984. In the meantime, diabetes work continued, and the achievements led to the shaping up of research strength and increased opportunities to interact with international groups of scientists which had now grown to link programs between the Department of Biochemistry in Colombo and IPICS in Uppsala.

Even with civil disasters and ethnic conflicts in the early 1980s, the Jaffna University in the North was established and some of the early founders of research collaborations joined the Jaffna University. Some senior scientists at the Department continued the collaborative tradition with Swedish counterparts and provided the leadership in the gene technology project, and began to develop a research facility for gene technology research at the Colombo University.

Initially, most research conducted was funded from the IPICS program, and SAREC support was also given to the Colombo University group. In 1986, a modest laboratory, the Molecular Biology and Gene Technology laboratory, was set up in a room at the Colombo University with a small grant of Rs 50,000.00 (approximately SKR 3000 in current prices) with a private local donor providing laboratory furniture and IPICS providing some essential equipment, material and support for training of personnel.

Apart from the genetic and molecular biology research work conducted in the laboratory, it was also responsible for establishing Master and PhD programs which commenced in 1987, to train young scientists, which was essential in developing capability in this relatively new field at the time. The group was able to make significant contributions to the advancement of biotechnology research. Some of the highlights are:

- Developed DNA based diagnostic techniques for the detection of human lymphatic filarial parasites
- Developed diagnostic DNA probes for filarial parasites
- Purification of DNS and isolation of parasites, antifilaria parasite work
- Established a bank of sufficient micro filariae
- Established a genomic library of the parasite
- Mapping of entire genome of the parasite

- Advancement of techniques to separate microfilariae from human blood
- Development of the most effective DNA probe for filariae parasite which won the WHO award.

These results and achievements contributed to international focus of the group and renewed the need to strengthen the institutional capacity with SAREC funding. In 1987, the group approached Sida/SAREC for an institutional grant, and in 1988, a grant was awarded to the Department of Molecular Biology of the University of Colombo to carry out their research. During these years, undeterred commitment of Swedish counterparts and IPICS was central for the growth and development of the group. Several researchers at the University Uppsala were responsible for steering the research work and their commitment led to continuous training of research personnel at the University of Colombo.

Deteriorating political conditions during 1987–1992 was a testing time for the group when intellectual work was not valued and a curfew and other restrictions of movement made it hard to operate a research laboratory. However, the Vice Chancellor of the University of Colombo was firmly behind the research group and provided enormous institutional backing. The assassination of the Vice Chancellor set the clock back for the group, and the University commitment to the Institute was somewhat dwindled. Despite these setbacks, the research group made a series of advancements in research by developing techniques for isolation of cattle and canine filarial and repeated DNA sequencing for diagnosis of Dinofiloriors. The research continued with several students completing postgraduate degrees.

Some of the researchers have made considerable contributions to the development of biotechnology research in some fields relevant to developing countries with applications that are central to economic prosperity. However, most researchers have operated independently without necessary structures and commercialization capabilities. One of the senior researchers claimed:

"My research on anti-diabetic plants yielded very interesting results. In the case of Momordica charantia (Karawila) a Japanese company with a Sri Lankan got a patent also citing my publications. However, none of the groups working on Karawila has so far come out with a pure compound(s). There are a lot of results which can be followed since an excellent experimental diabetic model is available. Microarray technology is the ideal approach today".

The significance of the research into Karawila was recently taken up by the Australian researchers.

Organizational Structure

IBMBB is governed by a Board of Management with 14 members. This however has its own limitations to move swiftly and act on research collaborations in a timely manner. The Board has financial and administrative independence and meets once a month. IBMBB is bound by university's financial and administrative procedures and is audited by the university auditors.

All academic matters are handled by the Head of Academic Committee. The Academic Committee provides advice to the Director on academic directions and research programs. The Heads of Divisions of other Faculties and invited members (teaching facility involved in decision making) are also in the Board of Management. The organizational structure is quite cumbersome for dynamic research organization with limited funds and research staff.

The university is responsible for employment of all academic and support staff. IBMBB also houses collaborating staff and visiting staff. The university is responsible for the maintenance services and other facilities such as computers, networks and internet services are paid from government funds. The institute pays VAT and other duties when importing needed goods and these are absorbed by the Government. This has been recognized as a significant problem when receiving external grants for research conducted in the Institute.

The projects were planned and selected according to the availability of full time scientists and /or PhD students, masters students to carry out preliminary work, availability of trained PhD supervisors, number of clinicians to collaborate by giving access to patients and clinical advice. External collaborators work with IBMBB staff and there is a number of visiting faculty. Sida/SAREC funding was provided to develop research competencies in the following areas: Parasite Molecular Biology and Biochemistry; Protein Science; Molecular Diagnostics; Enzymlogy; Plant Molecular Biology; Immunology; Reproductive and Developmental Biology and Neurology; Forensic Science; Tissue Culture and Bio-informatics.

It is vital that the institute develop its capabilities in core scientific areas and consolidate its capabilities in competencies in those areas relevant to the national development.

Future Development Strategies of IBMBB

The IBMBB is equipped with all modern state of the art instruments and facilities used in molecular life sciences such as fully automated DNA sequencers, Equipment for Micro-array technology, FPLC, HPLC, Fluorescence and Phase contrast microscopes, laminar flow hoods, animal and plant cell culture facilities, experimental animal house, cold rooms, local area networking, access to internet via dedicated optical fibre cable and is fully air-conditioned.

The Director outlined her vision for the future of the Institute in the following terms: "The area we would like to focus in a major way is "Screening for drug candidates from medicinal plants and marine flora with special emphasis on tropical diseases, hypoglycaemic agents and anti cancer agents" using a genomic and a bioinformatics approach. We have already identified Linnaeus Centre of Bioinformatics (LCB), University of Uppsala to collaborate on Data analysis. We may seek collaboration with KTH Microarray Centre and Centre for Molecular Medicine, Karolinska as well. LCB collaboration will probably come via the Swedish node for EMBnet (European Molecular Biology Network) and we (IBMBB) were elected unanimously as the National node for EMBnet for Sri Lanka last week. The other two areas that we will be focusing on will be cancer genomics and human DNA variation." These activities are expected to contribute to the development of Biomedical Sciences, Molecular Entomology, and Plant Molecular Sciences. Some of the critical development areas with potential future applications are identified as: Biomedical applications; Agriculture and crops improvements; Plants and genetic applications; Criminology and Archaeology or Molecular Anthropology

The Institute aims to contribute to human resource development at MSc/MPhil/PhD level in disciplines related to biotechnology. In order to achieve these goals the IBMBB conducts two MSc courses and it also provides opportunities to pursue research degrees such as MPhil/PhD programs. All courses are currently offered on a fee paying basis. The institute has already delivered 25 PhD/MSc/MPhil theses during 2000–2006. The Post Graduate programs are conducted by 14 supervisors comprising 11 female and 4 male and a majority of staff (12) have PhDs and 2 have MSc/MPhil qualifications.

Key Observations from the Case Study:

- Sida/SAREC investment in IBMBB is a critical step to boost biotechnology research in Sri Lanka.
- IBMBB is at a critical development stage and requires more inputs to establish its research and teaching functions.
- Business routines and management competence of the Institute is being gradually put in place. Institute needs strong scientific and entrepreneurial leadership to show its true potential as a regional and international player.
- Institute has an ambitious program. However, the realisation of such programs without further assistance to maintain and carry out business routines is highly unlikely.
- Institute must take adequate steps to become relevant. It should forge links with biotechnology and biomedical researchers in rest of the country.

- Institute needs to focus and lead in scientific fields and select projects which have short and long term benefits to national economy, industry and the public.
- Institute must actively pursue regional and national programs for globalization of its services and forge links with industry and strengthen already existing links with leading firms.
- Sida/SAREC assistance to infrastructure building must be matched with human capability building. It is necessary for IBMBB to strengthen partnerships with international universities (e.g. Uppsala University) in order gain significant returns on investment.
- Institute must develop strategic policies and embark on commercialization route to become self reliant and autonomous. It should review its management structures and set targets to become self-reliant within a given time framework.
- Government should assist and support IBMBB to realize its stated objectives and the University should be proactive in supporting the Centre. Government policy makers must take real action, not just paying lip service, to support IBMBB programs. Biotechnology is an important research program for the country and the institute has the potential to lead the national innovation system and should be strengthened with both financial and infrastructure maintenance support.
- Sida/SAREC should not totally abandon its support to this institute as it will be a colossal waste of Swedish tax payers money should the expensive equipment of the Institute is allowed to run down.

Case: Electrical and Electronics Engineering at Peradeniya University

In general, support for engineering research in Sri Lanka has been notably low. Industrial engineering research has traditionally been carried out at the Department of Irrigation, Ceylon Institute of Scientific and Industrial Research (now ITI) and National Engineering Research and Development Centre (NERD).

The academic departments of Universities at Peradeniya and Moratuwa housed two of the best engineering faculties, the major performers of engineering and industrial technology research. Engineering research culture is also lacking due to a weak manufacturing sector in the country. The demand for such research comes mainly from a few organizations such as the Electricity Board, Irrigation Department, and the Highways Department on a select number of problems and issues. Weak academic and industry linkages prevented much progress in engineering research, and therefore the University of Peradeniya and Royal Institute of Technology (KTH) collaboration, can be described as a most welcome development to move forward the engineering research capacities at least in one major university. The following case study outlines the achievements of this project.

Sida/SAREC funding for the project on "Research capacity building in electrical and electronic engineering" was focused on the Engineering Faculty of the Peradeniya University. This project started in 1994 was extended to 2008 and lasted for 12 years with four distinct phases.

The research concept was mooted by senior staff of the Electrical and Electronic Engineering Department of the University to submit a proposal to Sida/SAREC for a grant with KTH in Stockholm. The exchange of senior staff between KTH and University Peredeniya led to the development of a proposal which was funded in 1994. The project was initiated as part of the collaboration between KTH and the Engineering Faculty of University of Peradeniya, under the leadership of the Dean of KTH, Sweden, who was a member of the Research Council at SAREC at the time.

The initial research focus of the program was in the area of power. One of the main purposes of this program was to build the research capacity through research training at MPhil/PhD level and conduct joint research on areas relevant to research partners. The program began with the postgraduate training of students, with two students admitted to KTH for PhD training. Other objectives were to provide

essential laboratory resources and scientific exchanges. The program enhanced the capability of the teaching staff, and strengthened the existing postgraduate programs in electrical and electronics engineering. As part of the project training of technicians was also undertaken.

The project had four focus areas within the electrical and electronic engineering discipline. These are (1) Power energy and high voltage, (2) Robotics and automation, (3) Microelectronics and radar, and (4) Microwave and optical communication systems. These focus areas were managed as projects by different project leaders from the University of Peradeniya and Swedish counterparts from the Department of Electrical Plant Engineering of the KTH. The research agenda was initially identified by the Department of Electrical and Electronic Engineering at the University of Peradeniya. This project selection process was somewhat difficult due to variations in research competencies and had to be refined with mutual understanding. As the program matured, more academic and industry partners (such as the Ceylon Electricity Board) and Swedish research institutions (such as Chalmers University of Technology) collaborated in the program. The early phase of the project proceeded very well and the training of students using the 'Sandwich Model' helped to develop trust and relationships that deepened research work between the two institutions.

Scientific exchanges took place through courses, seminars, conferences and exchange of researchers between KTH and the University of Peradeniya.

Laboratory research started in parallel with the action to purchase equipment to refurbish laboratories at the University of Peradeniya. About SEK 10–12 million was spent on acquiring essential equipment and software necessary for research work and re-equip the laboratory which was used also as a teaching facility. Testing equipment in high voltage engineering was installed. This remains the only such testing facility in Sri Lanka. It was used for all high voltage equipment and devices of major institutions such as the Ceylon Electricity Board, Telecom, Lanka Transformers and Lanka Electric Company.

It took several years before the research programs were sorted out. This was due to differences in training work and the level of research competence of Sri Lankan scientists. The cooperation, which started with training and relatively small scale research programs, has gradually developed with mutual trust and understanding between different individuals and organizations. The selection of projects was also carried out during the process of institutional visits, discussions with project coordinators and leaders, and while conducting short courses. As the cooperation extended, the research team was able to further deepen their research strengths.

Some of the key research themes developed early in subsequent phases of the program includes Energy distribution in high voltage electrical equipment; Electronic system development (very advanced area of work at the time); Use of internet design of the system; and Detecting mines.

- On the outset of the program there were many drawbacks and issues that needed to be sorted out.
- Mentoring and providing welfare for students and providing for their intellectual needs
- Organize research and manage funding available for research work
- Source cooperation at the institutional level
- Build institutional support for recruiting students and student's welfare
- Conduct seminars and conferences and develop student/staff exchange programs
- Develop international links e.g. Zambia – students coming to Sri Lanka

A large number of research engineers were trained and most of them were released from their positions at the University and went back to their work places, and all but a few migrated to other developed countries.

Those who were trained were very successful in creating their own research teams and groups and building a critical mass. The University of Peradeniya received a total of SEK 25,593000 for the period from 1994/1995 to 2007 (See Table 6).

Some of the recent research projects extended to collaboration with medical research groups in computational biology and neuron computing and neuro-mechanical interactions. These extensions were possible due to doctoral work in cutting edge research conducted at KTH and Karolinska Institute.

Contribution by KTH and Other Swedish Institutions

With the development of this program, KTH has also benefited from the project. Since the commencement of the project in 1995, there has been a significant boost in research funding per researcher. In addition the number of students undertaking research increased. The theoretical contribution and knowledge based development increased substantially. The research group attempted step-wise development and this has systematically assisted high quality research outputs.

With regard to KTH staff, there were several factors that influenced the participation in this sort of a program. It was intensive and time consuming and the research productivity of staff was somewhat curtailed by the nature of the work attempted in the collaboration. Much emphasis was placed on training of students. This was a long and large project which required considerable motivation to stay on course.

The number of students gradually increased to more than double the number of students in subsequent years. Research undertaken in this project was applied in nature. As the program matured, the intensity of fundamental research increased and the basic research component was about 20%. Research on Design Systems, which was the third area, was one of the advanced areas.

The project has contributed some scientific findings, papers and manufacturing capability of some applications in the local situation. Since the project was capacity building there has not been a very strong focus on commercialization of the project. There were no patents, designs or development models developed during this period other than some potential applications and improvements to existing products and processes

Some of the projects selected were of direct interest to Swedish industry. This was also partly due to the fact that industry in Sri Lanka was at a nascent stage.

The major outcome of this project was the development of knowledge, and currently, the project group and the facilities available at the University of Peradeniya is the only one with such facilities.

The most challenging issues confronted by both KTH and University of Peradeniya researchers were:

- enhancing interaction and maintaining a positive collaborative spirit despite many cultural differences; encouraging Swedish students to visit local institutions; managing cultural gaps and select research projects that are doable and beneficial to all partners
- identifying and differentiating strengths of collaborating partners – for example "KTH was good at practical applications and University of Peradeniya was good at theoretical work"
- managing the expectations and needs of the students according to the 'Sandwich Model'. Typically, 50% of the work was done in Sri Lanka and the rest in Sweden.

With the 'Sandwich Model' type of training, KTH viewed the program to be most rewarding. Although strenuous for staff and students, it yielded positive impacts.

Contribution to the Program by the University of Peradeniya

In Sida/SAREC supported programs, a larger investment was made on human resource development in the area of research and research capacity and infrastructure building in higher education institutes. These support programs have established some critical mass in these places and also a reasonably good infrastructure for research such as the data network connecting all universities in the country. Future Sida/SAREC involvement as seen by local experts who underwent the capacity building exercise in the previous round of Sida/SAREC involvement feels that the same style will not bring optimum benefits for the country. Instead, the key areas to address would be: (a) A continuous flow of knowledge and expertise from academia to local industry, and (b) Commercializing research in universities.

The faculty of Engineering at the University of Peradeniya, is one of the two education and research training institutions in engineering at university level in Sri Lanka. No significant research was carried out at any of these universities in electrical engineering. The major hindrances were lack of staff, as the few faculty members had to engage themselves in teaching and undergraduate projects, little or no research experience of the staff beyond their own PhD degree work, popularity of PhD education abroad, the fact that students on completion of their courses rarely returned home and limitation in equipment to carry out research.

The Electronics Engineering Faculty was functioning from the Technical College in Maradana, Colombo, for 3 years before it was moved to University of Peradeniya's Engineering Faculty. In the 1990's there were 40 students. In 2008 the student intake will be increased to 100. Intake of Postgraduate students is also being increased.

There was no post-graduate program until 1995, when the culture began to change. Considerably large grants were received from Japan and ADB and the ADB grants kicked off the Postgraduate programs at the Faculty. If not for these grants students were reluctant to register for local programs. 17 researchers have benefited from the capacity building project, obtaining 8 PhDs, 6 MSc/MPhil and 6 Technical licensees (See Table 7 and 8.)

The Department provides basic courses to all engineering students on the principles of electrical and electronic engineering to a depth appropriate to the generalist, and advanced courses to the specialist student in areas of Electrical Power, Communications, Electronics, and Control. Admission to the Faculty of Engineering was subjected to government policies on University admissions. Upon admission to the Faculty of Engineering, the students need to qualify themselves for the Engineering course. This was done by a one-year Qualifying Course in Engineering.

The prime objective of postgraduate programs in the Department of Electrical and Electronic Engineering was to provide continuing education for practicing Engineers in a broad range of sub-disciplines in Electrical Engineering. The department offers the following regular postgraduate degree programs. The demand for postgraduate programs such as Masters Degrees is low as funding is a problem.

The project had undoubtedly created a considerable impact in terms of capacity building. The leader commented: "No new products or intellectual property have been produced by this project. However, the project has led the way to build up the equipment capacity of the department in a significant manner so that undergraduate program and postgraduate research capacity have been upgraded".

During our discussion with project people, we have discovered enormous potential this team will have in future product, process and service development if there is sufficient linkages and entrepreneurial support. For example, the project leader confirmed: "The focus areas of the project are of great importance for the S & T development of the country. Power energy and high voltage, robotics and automation, micro electronics and radar, microwave and optical communication systems will play a lead role in several years to come as far as the rapid development of the country is concerned".

The underdevelopment of local industry or a lack of mechanism to connect with existing industry has been a major impediment in the groups reaching relevance. A senior researcher interviewed commented:

"Though the department has acquired a significant amount of state of the art technology in the focus areas, there has not been any proper mechanism in place for the Sri Lankan industry to grab that knowledge and improve their products, technologies and services".

Several project leaders held the view that the root cause of the problem is the lack of skills to complete the innovation value chain. The project leader of this research project was of the opinion: "Financial support to initiate incubation facilities in the university premises, which can use the equipment base existing in the department acquired through the project, can be very interesting to have so that fresh graduates will be motivated to become entrepreneurs.

Financial support for building global networks of marketing and technology will also be a crucial thing for the success of this initiative. Another strategic model we could propose is financial support for R and D on product development, which can be used by identified industries in the country that are selected by the university for improving the technology in their products through university research.

The initiatives mentioned above will enable us to bridge the gap between university expertise and real manufacturing in industry".

Additional Observations from the Case Studies in Sri Lanka

- Sida/SAREC's assistance was instrumental in developing substantial capabilities and facilities that had enormous potential to contribute to national and global development. IBMBB and the Electrical Engineering, for example, developed a formidable research group in areas that are essential for national development. These groups need to be recognized and organized in such a way they could further the research capacity in the country.
- KTH recognized the cultural chasm that needs to cross in building research competencies and has commented that continuous work is required to cross cultural boundaries. There is some justification for funding for extended periods. However, there were no sunset clauses for extended support, and the expectation that research support may prolong for over 20 years, as in the case of IBMBB cannot be justified. There is a need for self-reliance and these institutions to push more towards research accountability and commercialization of research results. This has not happened in most projects.
- KTH recognizes the efforts and strategy needs for effective collaboration that needs to be learned as the projects progresses. It was also recognized that ideal collaboration comes from intellectual work where researchers can interact on a common research theme. This has worked extremely well in most cases where passion and interest for research has developed strong bonds between Swedish and Sri Lankan partners. Continuous work is still needed to develop the project to an entrepreneurial stage.
- Sida/SAREC's assistance and support to technology incubation facilities within the academic institutes would be extremely valuable. Sida/SAREC may choose some demonstration faculties such as the Department of Electrical and Electronic Engineering of University of Peradeniya for this purpose. Such facility may provide valuable assistance in linking with industry and building connections between industry and engineering graduates with entrepreneurial skills.
- The lack of industry involvement on the onset of these projects, especially on the Electrical Engineering project at the University of Peradeniya, can be seen as a major weakness where the selection of research themes was largely individual academic driven.
- Project management and project organization could have been arranged in different ways so that training and research components could be well integrated and managed.

- Sida/SAREC support has yielded multiple effects by developing research training, undergraduate courses and industry links in this program and these should be regarded as well managed program that can be used as model for other developing economies.

Swedish researchers welcome the opportunity to work with developing country partners for several reasons. The availability of research data, research situations that were unique and access to intellectual capital are some of the key drivers.

The University of Peradeniya had recently emerged as one of the most progressive academic institutions in Sri Lanka with high potential to contribute to economic and social development in Sri Lanka and the Sida/SAREC project such as this one has strengthened the research capacity and capability in industrial and engineering fields which are essential for this development process. The Vice Chancellor had taken steps to develop a ten year strategic plan for the university and has made reforms in the research system. It is essential that those strategies and the collaboration developed over the years through projects such as this be taken into account and leverage team efforts to build research competencies related to industry.

Part 4.2 Research and the Construction of R&D Capabilities: Evidence from Vietnam

In addition to our general assessment of the impact in Vietnam by the Swedish support to research cooperation, two specific areas were selected by Sida/SAREC for a more detailed review even at the level of individual projects:

1. Assessment of the impact of the support by Sida/SAREC to the Health program in Vietnam, particularly with the Hanoi Medical University as the main recipient.

2. Assessment of the impact of the support by Sida/SAREC to the Rural Development program in Vietnam, mainly through the Universities of Agriculture and Forestry in Hué and in Ho Chi Minh City.

The two project areas are reported in the sections below. We were asked also to make assessments in terms of research capacity at the individual and institutional levels, the capacity to secure funds from other sources, and the capacity to manage research funds.

3. Assessment of the impact of the support from Sida/SAREC to the Swedish partners in both Vietnamese programs (i.e. the health program, health systems research and common diseases at Karolinska Institutet, Stockholm; and the rural development program at the Swedish University of Agricultural Sciences (SLU), Uppsala).

The evaluation of the two main cases was done in Vietnam as well as in Sweden. We received additional information during interviews, roundtables and one-to-one meetings and through other source material, including facts drawn from special reports, in-depth interviews with some specialists and data analyses at specialized agencies.

Case: Sida/SAREC Support in Vietnam to Research Related to Rural Development, Natural Resources and the Environment

This section contains an assessment of the impact of the support by Sida/SAREC on the Rural Development program in Vietnam, mainly through the Universities of Agriculture and Forestry in Hué and in Ho Chi Minh City. As already indicated, we were asked to make assessments in terms of research capacity at the individual and institutional levels, the capacity to secure funds from other sources, and the capacity to manage research funds.

Here, we have chosen not to assess the broader "research cooperation for sustainable rural development in Vietnam", which has engaged up to nine institutions across the whole of Vietnam, while engaging also the Department of Rural Development at the Swedish University of Agricultural Sciences (SLU), Uppsala. Instead, we have selected a similar, but smaller program or rather project of activity which has actually involved a few of the same institutions, but has a more clearly defined research focus, which is on the integrated farming systems and livestock production of Vietnam. Clearly, there are many overlaps among these projects. The same specialists appear in both projects and in different roles, depending on the development phase of each project.

The principal research objectives for this family of projects related to rural development, natural resources and the environment could be summarized as follows:

- Strengthen multidisciplinary research, especially linkages between natural and social sciences, while developing a better understanding of sustainable rural systems.
- Strengthen 'holistic approaches' to research such as 'livelihood analysis' and 'systems thinking'.
- Strengthen the relevance of research to practice and policy in rural development and in the livelihood situation of the rural population.

By placing the Sida/SAREC support to research in Vietnam during the last 15 years within the context of such a comprehensive and ambitious agenda for sustainable rural development, the Swedish and Vietnamese experts involved in the individual projects were forced to consider also the wider innovation context of the research, the research training and the other research capacity building. Hence, projects ideas invented in the Swedish-Vietnamese collaboration within this context have represented a wide variety of issues for investigation, including these:

- Conservation farming development for poverty alleviation in coastal areas of Central Vietnam.
- Multidisciplinary studies aimed at the improvement of scavenging poultry system at the Bac Kan and Thai Nguyen provinces in the mountainous areas of northern Vietnam.
- Development of non-agriculture activities to diversify farmers' job and income for sustainable rural development in the Red River delta.

For practical reasons, as already indicated, we have not been able to cover all projects within this family of projects. Instead, we have chosen only one area of Vietnamese-Swedish project collaboration which, however, contains a very ambitious agenda for research in the sphere of sustainable rural development: The Livestock Production Project within the integrated farming systems research. According to our interview sources, this tropical livestock project contains the components contained in the "research cooperation for sustainable rural development in Vietnam" and should be a first-rate illustration of what has been achieved in this area of research and experimental development.

The Vietnamese partners are two of the five universities of agriculture in Vietnam. They are located in Hué and Ho Chi Minh City. Both are operating under the Ministry of Agriculture and not under the Ministry of Education.

The main objectives by the two Vietnamese universities, when using the contributions by Sida/SAREC to projects and to R&D capacity building, was related to R&D performed on integrated farming systems and livestock production. All persons involved in these activities, which we had a chance to interview (cf. Appendix), characterized the research cooperation with the Swedes as highly productive, cost-effective and leading to positive long-term effects on R&D capacity building at the relevant departments of the two universities. The interviews included persons who have retired from the universities, but maintained regular contacts with the remaining researchers and other specialists.

From a Vietnamese point of view, the long-term objectives of the collaboration were two-fold:

1. To develop the research capacity of the two Vietnamese institutions, while being involved in research and educational cooperation with partner institutions in Sweden. This was set to be achieved mainly by advanced academic training at the level of Master and PhD.

2. To carry out high-quality research on sustainable tropical livestock systems. This was set to be achieved mainly through project cooperation, which included participants from the Department of Animal Nutrition and Management of SLU (Swedish University of Agricultural Sciences), NIAH (National Institute of Animal Husbandry, Hanoi), the University of Agriculture and Forestry in Hué, NLU (Nong Lam University, Ho Chi Minh City), CTU (Can Tho University). There was also participation by NGOs (e.g. from Colombia).

Nearly ten years later, when our interviews were made, it is clear that these long-term objectives were reached an, moreover, that a range of other objectives and related tasks had been successfully achieved. From the beginning of the research collaboration with the Swedes, the research was performed to advance efficiency in producing appropriate livestock species. In addition, a variety of intermediate outputs from the research efforts for the use in rural areas were defined as improved methodologies for processing biomass (e.g. cassava, sugar cane, multipurpose trees, aquatic plants) with emphasis of producing new animal feed. For example, R&D activities were guided towards new methods of utilizing residues and agro-byproducts from food and fuel crops.

The Livestock Production Project was carried out in five phases (plus a phasing out period) from 1990–2003, based on a design invented in 1988 and approved for funding in 1989. Its main achievements could be summarized according to the following principal activity areas:

- Research training (PhD): During the five project phases, 12 Vietnamese from four institutions completed their PhD degrees at SLU (the Swedish University of Agricultural Sciences) according to the 'Sandwich Model'. This meant that training time was split between Sweden (an average of 18 months of research training and thesis writing) and Vietnam (the remaining time on field research). All Vietnamese candidates were awarded PhD degrees within the stipulated time of four years. All in all, more than twenty Vietnamese junior researchers/lecturers completed their PhD thesis work in Vietnam, Japan and Europe, while having Swedish supervisors/project consultants and Sida/SAREC funding.

- Other academic training (MSc): In parallel to the project, a large number of Vietnamese were trained within a collaborative Master program. Some of the Vietnamese students having written a Master thesis went further to write a PhD thesis in the same research program. The program in Vietnam was combined with a regional research network called MEKARN (Mekong Basin Animal Research Network), involving 13 universities and research institutes in Vietnam, Laos, Cambodia and Thailand.[13] MEKARN was financed in parallel to the Vietnamese project and capability building by SAREC. SLU was the Swedish coordinator of both the Vietnamese and the wider Southeast Asian research. In hindsight, one could claim that the MEKARN R&D activities grew out of the early success of livestock projects in Vietnam.

- Research on "Sustainable Livestock-Based Farming Systems": The program on farming systems integrates the two training activities just listed, while its main research components is to execute research projects and provide financial support to research projects through competitive research grants. The practical focus is not on large, commercial farming but on integrated, livestock-based

[13] www.mekarn.org. The MEKARN program, considered highly successful also as a regional research network managed from Vietnam, is operated from HCM City by the Nong Lam University and offers the lower Mekong river region networking capabilities and outreach activities towards small-scale farmers.

small-farmer systems. Examples of specialized sub-projects in support of small-farmer systems in Vietnam are

(a) Studies on the utilization of agro-industrial by-products for ducks in the Mekong Delta of Vietnam.

(b) Effect of supplementation of scavenging chickens on feed intake, nutrient digestibility and performance in Vietnam.

(c) Mycotoxin contamination of feeds in Vietnam.

(d) Animal and feed factors affecting feed intake, behavior and performance of small ruminants in Vietnam.

Most of the research results have already been transferred into the small-farming system of Vietnam. Two examples: Moldering sugarcane by returning dead leaves has resulted in increasing crop yields of three to four times as well as general improvements of soil fertility. Low-cost bio-digesters were introduced in 1992 and since then more than 70,000 units have been distributed and installed at farms across southern Vietnam, where the farmers themselves are the demonstrators. (It should be underlined that agriculture extension services were not introduced in Vietnam until 1993. In that period of time, agriculture extension was perceived mainly as a way to perform technical updates and not understood as a broader set of services (including technical updates) to improve agriculture within the context of rural development. This was reflected also in the recruitment of specialists for this service.)

According to our roundtable review in the spring of 2007 by four of the professors involved in the project, the activities and deliverables have been well attentive in reducing poverty in the rural areas; results have enhanced food safety and improved the sustainability and income of livestock farming in Vietnam. One example is the development of a system to replace cereal grain with sugarcane juice in pig production. A claim was made that many thousands of Vietnamese families are now benefiting from this particular technology and related know-how.

Until today, the "Sustainable Livestock-Based Farming Systems" in Vietnam has delivered some 80 scientific papers published in international journals and 20 in the local journals. Diffusion of research results have been organized as new teaching programs in all institutions involved (e.g. 'sustainable tropical livestock systems'). To reach wider audiences, five international week-long workshops were held in 1991, 1993, 1996, 2000, and 2003 at Nong Lam University with published papers and proceedings.

In retrospect, this Sida/SAREC support in Vietnam within the context of rural development, natural resources and the environment contains a whole series of success stories and lessons to be learned:

The program just described has been very comprehensive. It has involved a whole chain of activities from research, research training, and experimental development in real time involving user communities while at the same time strengthening the capacity building at several of Vietnam's leading institutions for research and education in agriculture and forestry. In parallel to this Sida/SAREC support program, wider regional networks of collaboration with researchers, other specialists, students and stakeholders in the neighboring countries as well as in other parts of Asia have been established and put into full operation. There is now several South-South collaboration schemes (in research, scientific conferences, training, sharing of data, etc.) operating as an outflow of the Sida/SAREC program.

The 'Sandwich Model' applied in this program for research training is also considered highly successful by the Vietnamese. The speed and quality in the academic training achievements are commendable, we were told in the interviews. The individual and joint training activities, which always included research tasks in Vietnam or related to Vietnam, made these efforts particularly relevant.

The initial leadership offered by researchers and educators at the corresponding institutions in Sweden were instrumental in shaping advanced designs for the research and teaching collaboration and for

introducing early a practical end-user perspective that helped create a very dynamic research and educational environment. Swedish researchers, we were told during the interviews in Hanoi, Hué and Ho Chi Minh City, helped introduce new perspectives on existing research objectives and foster effective operational tasks in at least five higher education institutions in Vietnam related to rural development. The program came to offer also new global, Southeast Asian and South Asian perspectives on research on livestock production and farming systems, which otherwise may not have been achieved.

The professional relationships which have evolved since the project identification in October 1988 until 2007 have been intensive and rewarding for the partner institutions involved. When we were meeting senior and junior academic staff at the Universities of Agriculture and Forestry in Hué and in Ho Chi Minh City, examples were given of research collaboration and exchange of scientific research developed after the program was officially ended in 2003.

In terms of research capacity building at the institutional level, it seems clear – during our visits to the two Vietnamese institutions – that they have benefited greatly from the Sida/SAREC engagement. Later, they have been able to get funding from other sources and their capacity to manage research funds has become more professional. Their international networks in research and their cooperation with regional and global partners have been greatly facilitated by the long-term Swedish assistance.

The methods and means to connect the research process with end-users in the farming communities in various parts of Vietnam section have been improved significantly at both institutions. This was described to us as an original, enduring contribution by the Swedes to a Vietnamese institutional rural context with experimental farms. Instead and by examples, the Swedes established direct links to a broader community of farmers and other food producers/distributors. Furthermore, examples were given of other modes of effective diffusion, interaction with end-users and commercial applications of research results providing a broader innovation environment for applied research and experimental development.

From the Vietnamese horizon, after many years of cooperation, the Swedish researchers and other experts based at the "rural development program" of SLU, Uppsala, are considered highly-competent and with relevant experiences from rural development in tropical and sub-tropical countries. Their excellent research networks in developing countries seem to have strengthened also Vietnam's contacts in the neighboring countries and in other Asia.

According to our interview persons, the research collaboration between Sweden and Vietnam seem to have operated effectively throughout the period under study. Research training, using the 'Sandwich Model', which allows the students from Vietnam to alternate regularly between Sweden and Vietnam has been effective, according to our interviewees. Not only has the 'Sandwich Model' been effective in training and in making the field research more ip-to-date and relevant. It has also stimulated the homecoming post-graduates and PhDs to pursue their professional careers in Vietnam, even starting the career while doing postgraduate work in Sweden. For female students, the 'Sandwich Model' may have been particularly useful, since Vietnamese women working as professionals are expected also to allow more time to their children than their husbands.

Case: Sida/SAREC Support in Vietnam to Research Related to Health, Health Systems and Common Diseases

The risk of capturing an infectious disease in Vietnam is relatively high even in the main urban areas. Bacterial diarrhea, hepatitis A, typhoid fever and other food or water borne diseases are not uncommon. Vector borne diseases such as dengue fever, malaria, Japanese encephalitis are high risk diseases in some locations outside of the main city areas. Since a few years, the highly pathogenic H5N1 avian influenza has been identified among birds in Vietnam and in Southeast Asia.

HIV/AIDS remains a significant problem in Vietnam. At least a quarter of a million people are infected, probably many more. With help also from specialists from Sweden, Vietnam pursues an active policy of prevention.

For years, even during times of war, Vietnam has been known for its well-organized national system of health services. Still, now with a population of more than 85 million inhabitants, the system has many deficiencies in quality and in geographic coverage.

In August 1976, when Swedish bilateral support to Vietnamese R&D was initiated, following a visit by a government committee[14] to the State Commission for Science and Technology, research cooperation in epidemiology and hygiene were the first two areas proposed by the Vietnamese. Since 1977, when the first joint project was funded by the Swedes, infectious diseases have been at the core of research collaboration. In both countries, the leading institutions in this area of health-related research have been actively involved.

Here, Swedish research support was first targeted at the Vietnamese National Institute of Hygiene and Epidemiology, which engaged the Swedish National Bacteriological Laboratory in joint research, research training and related work over a period of 14 years. Other Swedish research institutions (e.g. Karolinska Institute) later joined forces by establishing research projects in the same and in related epidemiological fields, fully funded or co-funded by Sida/SAREC. The Swedish support boosted this part of medical research in Vietnam considerably.

In retrospect, our fact-finding shows that Swedish support helped develop some of the most advanced biomedical and biochemical research capabilities in Vietnam. These capabilities were developed to support selected areas of medical practice and public health, while targeting specific diseases, e.g., diarrhea in a variety of forms. The bilateral research collaboration was managed to offer vaccine candidates, training in diagnostic methodologies, use of advanced laboratory equipment, etc.

The initial period of research collaboration included specialized training (e.g. research training and training of research engineers and laboratory technicians) along with the transfer from Sweden of medical equipment and other technological devices related to various medical fields. The first five years of collaboration aimed at transforming the Vietnamese counterpart laboratories into 'national reference centers' for the monitoring and control of, e.g., diarrhea diseases. Another objective, considered as important, was to enhance research capabilities in Vietnam to allow advanced research collaboration with specialists in Sweden. Human resource development in the form of research training at several levels of specialty and other training has been a principal component of the research collaboration from the beginning until today.

Here, it is important to mention that support to hospitals and other health services, including pediatric specialties, as well as the funding of advanced medical equipment, have been provided in the Vietnam by the Swedish government separately from the research cooperation schemes by Sida/SAREC.

The early efforts of constructing R&D and testing capabilities in Vietnam became the founding stones for thirty years of continuous collaboration with research institutions in the two countries. The number of institutions involved in the long series of research projects has grown and changed in composition in both countries, but some of the original specialists involved have continued to work together year after year, while the cooperation was extended to include other research institutions, academic hospitals, health policy agencies, etc.

We were told by specialists interviewed in both countries that the long-term, deep professional engagements formed part of the success story. The means for success included strong professional and per-

[14] Beredningen för u-landsforskning, later to become Styrelsen för u-landsforskning (SAREC).

sonal relationships, robust institutional connections at the level of departments and research groups, uninterrupted exchange of research results and experiences, and synergies attained also through regional and international networks of supporting specialists.

Apparently, the research funding by Sida/SAREC for such a long period of time as 30 years was a most important pre-condition for these productive research relations to evolve, expand, grow deeper and become highly productive in terms of scientific results (registered in the number of scientific papers, Master and PhD thesis work, international conference participation, etc.), and number of patients and other people affected in Vietnam as well as health policy measures taken.

There has been a relatively high stability in the preference of scientific fields for cooperation. The institutions for bacteriological research have been midpoints for extensive field work, e.g. for medically related experiments across Vietnam by Swedish as well as Vietnamese researchers, medical doctors and other specialists. Some of the same areas of health-related research cooperation have been maintained and extended over the years with interaction. Other areas in subfields of bacteriology have been added such as studies of vaccines especially relevant for tropical and sub-tropical areas (e.g. Malaria), resistance to antibiotics, etc. Production of vaccines was later added to the portfolio of health-related projects, funded or co-funded by Sida/SAREC.

However, according to our fact-finding missions in Vietnam, there were often administrative problems in maintaining and developing these projects and to make them cost-effective. When the State Commission for Science and Technology became a Ministry (and better professionally staffed), the research planning, priority setting and the overall management of the projects were made more effective. On the other hand, the relevance of the projects conducted was never questioned at any stage of the long-term research cooperation.

Furthermore, the impact of the individual projects that we looked into on the health situation in Vietnam is considered high. Swedish and international experiences in these fields of research have been essential, we were told, for the advancement Vietnamese policy and for medical practices and the provision of specialized health services, including preventive medicine. Yet, even after thirty years of cooperation, much remains to be accomplished. Much depends on radical changes in the general composition of the population, urbanization, poverty in the rural areas and other socio-economic changes in Vietnam.

Along with the economic restructuring over the past 21 years, the national health system has changed to become more accessible to persons paying fees to have fully-fledged access to these services, while persons will little money may have problems of access. The 2006 estimate of Vietnam's GDP per capital is US$3,100. However, the distribution is highly uneven. According to US estimates, 19% of the population is considered below the poverty line.

As another health-related feature, we should emphasize that more than a quarter of the population is younger than 15 years and that the services to infants and your persons are managed relatively well. Infant mortality is 24% of 1000 live births. The annual population growth rate is currently a little more than 1%. Current life expectancy at birth is 71 years.

The remaining part of this section offers a summary and an assessment of the impact of the relatively large health research program, supported by Sida/SAREC. Here, the focus is on the last ten years of Swedish support.

In the opening phases, during the 1970s and early 1980s, the bilateral collaboration consisted mainly of capacity building in Vietnam, including training of researchers, medical device technicians and other supporting personnel. Later, proper research collaboration evolved and made possible close professional relationships, which have been functioning and very well exploited until today.

From a Vietnamese perspective, the early cooperation in these health-related fields of expertise has proved especially important, when trying to master the prevention of local and regional epidemics like bird flue/avian influenza and HIV/AIDS. From a Swedish perspective, first-hand insights into tropical and subtropical medical environments over a considerable length of time, while working with local specialists, forms part of a valuable learning process that could be useful in research on vaccines, other drug development (including plant drugs), antibiotic resistance, prevention of pandemics, etc. Persons interviewed have emphasized the importance of these collaboration projects for researchers and stakeholders in both countries.

As already indicated, based on these experiences a range of projects have been implemented covering wide issue areas as pathogenesis, diagnosis and treatment of common diseases and development of new diagnostics methods for non-communicable diseases as well as for infectious diseases. During the past ten years, the research collaboration related to health has kept its original core (especially towards infectious diseases), described earlier in this section, but the collaboration has expanded into several other areas, including national health policy, management and utilization of health care systems, private health care reforms, public health care and gender issues, etc. In addition, Swedish research results and expertise also in reproductive health, adolescents and health seeking behavior patterns has been sought for by the Vietnamese. These relatively new areas of research cooperation and the related transfer of know-how to Vietnam have become particularly relevant as Vietnam has attempted at several health care reforms.

Research at Karolinska Institute and at other Swedish institutions in these broad, policy-related fields of public health, organization of management of health systems, etc. is recognized across the world, while Vietnamese research in these issue areas has been very limited. However, with the internationalization of research institutions in Vietnam, the situation is changing relatively fast – particularly during the past ten years. Vietnamese researchers have become more frequent contributors to other international research projects related to health. Their engagement in health policy formation has elevated some of their research results into actions taken at the national level. Examples could be taken from their recent work on the identification, prevention and control of epidemic diseases.

In Hanoi, Stockholm and Uppsala we conducted extensive interviews with researchers, other specialists and project managers involved in the Health Systems Research Program. In Vietnam, the health systems program is operated by the Hanoi Medical University in collaboration with the Institute of Health Strategy and Policy, which is part of the Ministry of Health. In Sweden, the program is managed by the Karolinska Division of International Health and Umeå University's International School of Public Health.

Within the Health Systems Research Program, considerable investments have been made in research training and other capacity building in Vietnam. Most recently, post doctoral training schemes have been planned. The human resource build-up is performed along with the on-going Swedish-Vietnamese research projects.

According to the Vietnamese interviewees, the Sida/SAREC 'Sandwich Model' has proved to be a very successful tool not only for the actual training of researchers and policy specialists, but also for the swift transfer of new methods and means for analysis, management and organization in the health sector that could be adapted and executed within the special context of health policy planning in Vietnam. Institutional partnerships and person-to-person working relationships among specialists in the two countries were made easy and effective by the 'Sandwich Model', by short courses on site in both countries and by some related staff exchange. It has also led to a more long-term presence in Vietnam by Karolinska, which recently has opened its own liaison office at the Hanoi Medical University to serve its own researchers, research students and other personnel doing research work, training and consultancy in Vietnam's health sector. This is further evidence also of the growing internationalization of research in Vietnam.

In the Health Systems Research Program, the emphasis in Vietnam has been on the adaptation of health services to a more market-oriented health sector reform model, including various health insurance models. For example, a series of reform proposals have been screened regarding health systems advancements, changes in community needs, etc. Special studies are planned or already made on inequalities in Vietnamese health care, health economics, consequences of irrational drug use, increased mental stress due to radical changes in society, malnutrition and infections, etc.

At the same time medical research cooperation with the support of Sida/SAREC continues with a focus on infectious diseases such as HIV/AIDS, avian flue and TBC – all related to the epidemiological transitions in Vietnam and in the world. It is clear that this research is of special importance also to the Swedes. This also means that the self-interest by Swedes research institutions to engage in global nodes of such studies (in Asia, Africa, Latin America, etc.) is growing in importance. I Infectious diseases in the tropical and sub-tropical parts of the world could have a direct and immediate impact of the conditions for public health in Sweden and in the rest of Europe. Interest among Swedish specialists is growing also for Vietnamese research on non-communicable diseases, reproductive health and drug use. The globalization of health has become a major issue also for Swedish research capacity building.

According to our source material, and confirmed in some of the interviews among specialists in medical and biomedical research, these broader fields have become part of the existing research capacity in Vietnam. Much more could be done to strengthen this capacity, but there are already specialists trained in Sweden and elsewhere, funded or co-funded by Sida/SAREC. Experiences have been gained through joint projects, workshops, study visits, etc. There is also a direct involvement by other universities and research institutions, which were not part of the original institutions involved in the Sida/SAREC-funded collaboration.

Most importantly, the awareness is great among researchers and other specialists and among key decision-makers, whom we met for interviews and at roundtable meetings, about the complexities and intricacies of these health-related issues. Vietnamese specialists are now very much participants in a wider dialogue among experts and policy-makers on the global and local issues of health and well-being, health research and the varieties in the provision of health services. When visiting institutions and meeting persons in Vietnam involved in or related to the Sida/SAREC research efforts in health, we found many examples of advanced competence formation in research of relevance to advanced health service provisions. The reference points among specialists in Vietnam of today are not only national and regional, but global.

Additional Observations from the Case Studies in Vietnam

- In general terms, Sida/SAREC's support to Vietnam for the education and training of students at the Master and PhD levels and to the specialized training of research librarians, documentalists and other technical staff have been highly instrumental for Vietnamese institutions in the formation of R&D capabilities.

- Although relatively costly, the 'Sandwich Model' for education and training has operated efficiently and secured that the research performed during the research training has remained relevant to Vietnamese needs. Very few researchers trained according to the 'Sandwich Model' seem to have remained outside of Vietnam after completing studies and research work abroad. Moreover, according to our interviews, the Model seems to have made it easy for female researchers and other specialists to benefit more extensively from training and related research work abroad, while staying in close touch with their home institution.

- Most R&D projects funded under Sida/SAREC schemes have stimulated the formation of research capabilities that go beyond the project period. The combination of relatively long-term research projects and research training seem to have

- Alternative funding sources for research and experimental development, when Swedish funding has diminished or even ceased, seem to remain a problem.
- The Sida/SAREC projects and training activities under scrutiny in this poroject have fostered multilateral and international research practices among Vietnam research scientists and engineers. This seems to have opened for wider research engagement and created a more robust basis for collaborative research work across national and regional borders.
- Management practices and modes of research collaboration in the Sida/SAREC projects seem to have had a strong impact on the institutions and the individuals engaged in these projects. Even project officers that have completed their research work together with Swedish colleagues remained positively influenced by these practices and modes of research collaboration when working on other projects.
- Principally, the 'open fund' of R&D and related funds, administrated in Hanoi by Vietnamese specialists in cooperation with by Sida/SAREC, represents a new and inventive way of securing flexibility and inventiveness in supporting bilateral research collaboration and in shaping capabilities for research. However, such an institutional venture will need more of transparency and accountability to become a successful operator in Vietnam's research system.
- Like in Sri Lanka, the lack of private sector involvement in R&D projects may have hampered the diffusion of early results into productive usage. Innovation will need more of multi-actor approaches to project organization. Sweden's own problems (and its ways of solving them) in using R&D results as raw material for knowledge-intensive innovation could become important ingredients in the future collaboration schemes.

Part 5
Strategic Impact of Swedish R&D Support

What are the lessons learned and which are the recommendations to be given to the research communities and authorities in the two countries regarding the future development of their research capabilities and national research system? In Vietnam (and in Sri Lanka), we were asked also to assess the long-term impact of the support by Sida/SAREC. Such assessments can be done in many ways. See other parts of this report for impact analyses, which are summarized in the various case descriptions. Here, in this part of the report, we will elaborate issues that some of the more senior interview persons in Vietnam emphasized, when asked about the strategic or long-lasting impact of Swedish R&D support.

Strategic Impact of Swedish R&D Support: Benchmarking and Role Models

Several of the leaders of research institutes in Vietnam which received early Sida/SAREC funds expressed to us that they became more nationally-recognized and even more scientifically and technologically capable – in a strategic sense – by having continuous Swedish R&D support and not just project-by-project funding arrangements. By such long-term support, they claimed in our interviews with them, they were recognized across the R&D community as nodes in the national network of R&D institutions. Moreover, they were distinguished among their peers as especially well-connected to international research. The image of being a special institution attracted young talents and enforced new and already existing networks of communication and collaboration across the country. The number of researchers being trained through Swedish funding at each such center was not really important, but rather the fact that there was a long-term relationship of internationally associated research efforts at the project and program levels.

In other words, these institutions achieved a new brand value, which helped create internal, professional confidence in the research being done at each institution, and made the brand useful for external (national and international) marketing. One observer told us that the members of these Swedish-supported institutions were "proud and more confident" than researchers at other, similar institutions. They saw themselves – and were often seen by other researchers – as role models to follow.

In this sense, Sida/SAREC was instrumental in creating higher benchmarks for post-war Vietnam. For example, one of the institutions in Hanoi, noted for its long-term support by Sida/SAREC, was often referred to in admiration by others as the institute with particularly good researchers and effective leadership without, actually, any detailed insights by outsiders into the institute's affairs. Hence, and this must be underlined, we are talking not only of the 'real value' of these institutional brands, but of their 'face value', which might not always be the same.

Strategic Impact of Swedish R&D Support: Leadership

Leadership identification and acknowledgement is an important single factor also in Sida/SAREC support to particular R&D institutions, departments, centers and labs. In Sri Lanka as well as in Vietnam people, engaged in Swedish-supported R&D projects, have been spotted and sometimes awarded individual training, travel and research grants or been hired as consultants. From our fact-finding, this type of breeding of leadership in R&D has not been a declared goal by the Sida/SAREC although it is clear that much of the Swedish work done in planning and monitoring of R&D between the negotiations at the level of the two governments has been achieved through informal, high-value advice by special advisors among local researchers and other experts, doing work in their personal capacity as multi-talented individuals.

Such promotion and use of leaders in R&D is certainly not unique for Sida/SAREC. There is a growing trend among international funding agencies of R&D to recognize, support and take advantage of outstanding talent across the world. From our case studies in Vietnam, it is clear that leadership issues are at the heart of the most successful R&D programs and projects.

Research and scientific leadership is required in constructing national, regional and local research institutions. After its recent wars, Vietnam has shown dynamic leadership in developing science and technology for wider purposes. Key initiatives derive from political leadership at the level of the central government, from some of the province governments and even from the major city governments (and not only from Hanoi and HCM City, but also from cities like Haiphong, Danang, Hué, etc.). These and other Vietnamese cities have separate departments for science and technology, managed by research scientists and other well-trained professionals.

In Sri Lanka, politicians and researchers have not been able to work together as efficiently as in Vietnam and seem to have been at odds when it comes to leadership and strategic management of scientific research. Without policy involvement and strategic research leadership, efforts by scientists, R&D engineers and their supporting staff could become ineffective simply by being uncoordinated. The lack of leadership is apparent in many areas of the sciences and among the institutions responsible for research management and implementation, probably resulting in limited economic outcomes and societal impact.

The models for Swedish and other external promotion of leadership in R&D (and innovation) differ greatly between sectors (e.g. industry-related versus agriculture-related R&D) and levels (national, regional, city, individual, etc.). For example, Sida/SAREC's leadership promotion in Sri Lanka and Vietnam may address skills and special qualities among individual heads of departments/centers, while bringing their organizations to scale; bankrolling key individuals in what they already do exceptionally well, awarding research groups with opportunities out of the ordinary, etc.

We recommend Sida/SAREC to look back and make explicit its own experiences in promoting leadership in R&D and to identify new program elements that will make leadership development a element of strategy in countries like Vietnam and Sri Lanka.

Part 6
Swedish Research Cooperation: General Observations and Concerns

Before making ten general recommendations for the future research collaboration between Sri Lanka and Vietnam (cf. the next section of this report), we will summarize below some general observations and concerns, drawn from our investigatory work in the three countries, and in particular from the interviews made with persons that have been engaged over considerable length of time with Sida/SAREC-funded cooperation projects and other bilateral activities.

(a) Program Design and Delivery in Relation to R&D Capacity Formation

The design of programs and selection of research priorities have taken many forms and some of these may not have been the most effective routes to identification of research and capacity needs. In some of the projects that we have looked into, research capabilities operate at a very low intensity. Efforts to strengthen such capabilities must be examined using multiple criteria that link also with national efforts.

In Sri Lanka, many deserving projects and needy causes will remain, but all these cannot be funded. The main weakness of Sri Lanka's science building efforts is the lack of foresight, science and technology development strategies and the absence of scientific leadership. Scientists are equally to be blamed for their inability to follow through projects, collaborate with other scientists and their inability to provide leadership and vision for the younger scientists. Future support for science building has to be given only for those who are willing to collaborate and cooperate genuinely by breaking away from institutional and personal barriers to collaborate in achieving practical as well as academic excellence.

Sida/SAREC support played on marginal impacts on strengthening national innovation system in Sri Lanka due to misalignment of expected outcomes and country's development needs. Often expected project outcomes were not aligned with S&T capacity building needs. For example, Sri Lanka has received massive Sida/SAREC support for the Buffalo Program, but only little evidence indicates that this program has had a continuation leading to new or re-enforced R&D activity. As a program for building research competencies and capacities at the national level, it can be argued that the Buffalo Program made significant contributions. However, in the absence of national and other efforts to follow up on the basis of this research, the program has not taken off with new activity or stimulated other research. There are few efforts made to link the researchers from the program with growing fields of science and technology in Sri Lanka such as biotechnology, new materials and medical sciences.

Sri Lanka's science development effort was built on individual passions and achievement rather than systematic development and contributions to the field of study. The result was fragmented groups often competing for limited resources available to them. Without Sida/SAREC's support, some fields such as biotechnology research would not have been possible to get off the ground. Unfortunately, limited Sida/SAREC's support was not adequately strengthened with local support. Many projects were developed according to the interests of individual researchers and their lobbying capability with policy makers. There is little evidence that this coordination can be substantially improved. In fact, our investigation suggests that there seems to be a fear of internal competition for funds; hence the growing suspicion of collaborative efforts.

In the case of Vietnam, the integration of the Sida/SAREC-supported R&D projects and programs into the national priority setting in science and technology seems to have worked better. Examples could be given from health-related research programs, including their clinical impacts, which stimulated further research funded at the national level. Similar effects by Sida/SAREC program on R&D capacity formation in fields like geotechnical research, agriculture research, environmental research, library sciences, etc. were mentioned to us.

In Sri Lanka, there were signs that program delivery has not improved much over the past 30 years. Practical project issues – such as lack of spare parts, difficulties in procuring chemicals and in attending seminars and conferences abroad, limited access to scientific information – remain part of the problem of capacity formation. Despite a scientist being appointed as the Minister of Science, scientists in Sri Lanka are still fighting a bureaucracy that had persisted for over 30 years. In an interview it was claimed that researchers spend more time administering research grants than engaging in actual research work. The procurement and maintenance of equipment remains difficult.

(b) Research Capacity Building

In Sri Lanka, research capacity building is confined to a limited number of university departments, leading public sector research institutions and initiatives of the National Science Foundation. Some of the University centers such as the IBMBB at Colombo University have displayed real R&D capacity and a potential to provide leadership in biotechnology development. However, the success of this institute depends solely on national commitment and efforts of relevant government authorities to strengthen molecular and biomedical research.

The Sri Lankan government needs to give serious consideration on how to strengthen the country's scientific capabilities. The recent announcement of another expensive R&D research initiative without consolidating on already existing expensive initiatives may become a problem. The Nanotechnology Institute probably needs to be aligned with the several groups that have already been working in various areas of biotechnology and medical research related to nanotechnology. Research programs of existing groups may need to be reformulated and linked to get optimal results from the limited research competences available.

In Vietnam, the capacity formation seems to have reached a higher level of coordination, while initiatives taken at relevant ministries, national agencies and institutes, and the National Council for Science and Technology Policy show a consistency in priority setting. There is also a stronger capacity behind strategic policy making related to R&D and innovation by government think tanks – with large professional staff – such as the National Institute of Science and Technology Policy and Strategy Studies (NISTPASS) and the Central Institute of Economic Management (CIEM), which are well-connected to counterparts in the region and globally. Being more regionally integrated and being one of the top-five fastest growing economies in the world during the past ten years, Vietnam has now relatively more resources available for R&D and innovation than Sri Lanka. Vietnamese institutions have developed R&D relationships with R&D centers in wide range countries, which has stimulated the policy discourse and provided benchmarks for research capacity formation.

(c) Strategic Interventions

In the case of, over the last 30 years investment in Sri Lanka has built considerable linkages between Sweden and Sri Lanka. Most research scientists and engineers that we interviewed in that country agreed that Sweden has provided useful, wide-ranging support.

It seems important for the research institutions in Sri Lanka that Swedish support will leave long-lasting impacts, nourishing the funds and other efforts of Swedish research institutions. The bilateral linkages, supported by Sida/SAREC funding, seem currently at a relatively fragile state. At this stage, a complete abandonment of Swedish support to research in Sri Lanka could become counterproductive for the parties involved.

Strategic interventions seem necessary for maintaining a continued momentum of the bilateral initiatives that will allow some of the current and recent projects to develop further. There is a need also among Swedish counterparts to define their own, long-term interests in these bilateral relations. We found such a strategic interest among the Swedish specialists that we met during roundtable deliberations in Stockholm and Uppsala.

Vietnam operates its R&D within a different overall context compared to Sri Lanka's contemporary civil war economy. Southeast Asia's economic integration stimulates Vietnam's dynamic, high-growth economy. Like in Sri Lanka, Vietnamese researchers and other specialists maintain good bilateral R&D relations with some of their counterparts in Sweden. However, not much of bilateral research collaboration outside of the Sida/SAREC-funded programs was reported to us, but it seems as if Vietnamese researchers remain interested in continuing to work with Swedish research colleagues and other specialists, given a generation of relevant, good-quality track records. Strategic interventions may be needed on both sides to provide the extra funding needed at the level research groups and institutions for such bilateral research cooperation across the continents to operate effectively.

(d) Project Management Competencies

In Sri Lanka, capacity building and project management was undertaken with limited experiences on how to design and implement an ideal R&D framework. Moreover, there was not much of professional expertise and managerial control of the processes in support of R&D capacity formation. During site visits and in interviews, we found that management competencies at the project level had developed and were maintained and even further developed. Cf. other sections of this document. Limited evidence is available that capacity building has been effective when considering the level of investment in the training of project managers and other leaders in research. After some projects had been completed, the research groups behind these had simply dissolved and we found no trace of continued efforts to design and manage new projects.

In Vietnam, the project management capability still remains a weakness, where planning, financing, procurement and conducting research is required for basic project management skills. Yet, the situation in the projects that we have investigated more closely seem to relatively well-functioning and efficient. The national support-capacity, separately funded by Sida/SAREC as a secretariat (the PMU Office) in Hanoi, has set relatively high standards for the management and reporting from the projects. We were told that these project management standards have positively influenced other international projects, even projects fully funded from Vietnamese sources. The PMU Office still operates under the auspices of (what is now called) the Ministry of Science and Technology, but with its own premises.

In Sri Lanka, for the overall design of projects, Sida/SAREC has benefited from advice from national agencies such as the National Science Foundation and the University Grants Commission. These agencies – though effective in other ways – have not been able to operate with full capacity due to the relatively disconnected scientific and technological infrastructure. In some cases, as a result of administrative procedures, the project management activities were handled by individual researchers, clearly not trained enough in managing such activities efficiently. This led to serious accounting problems in some projects in Sri Lanka. As currently structured, it seems as if some Sri Lankan scientists spend too much time administrating research grants relative to actually performing research.

During discussions with the Vice Chancellor of Peradeniya University on these administrative issues, the inadequacies in the past were recognized. A more transparent and effective system to manage research projects has been established and the university has appointed a Director of Research and a Pro-Vice Chancellor responsible for developing research capacity. Such initiatives, although coming at a late stage, would be needed to facilitate prospective Sida/SAREC-funded research efforts.

(e) Value for Money and Long-term Effects

Sida/SAREC support during the last 30 years has focused on specific projects and on related research capability formation, while funding the actual research activities. Sida/SAREC and other Swedish government agencies have helped strengthen capacities and improve capabilities through institutional development and reform and provision of specialized research equipment related to prioritized research areas. From our local investigations in Sri Lanka, it seems that more efforts could have been done to achieve substantial economic returns of the investment under the Swedish-funded research programs. Given the limited scope of our project, these issues were not explored in at the project level.

(f) Outcomes

In several of the Sida/SAREC research projects under study, the outcomes were extraordinary. This is due also to the collaborating institutions in Sweden, focused on tangible research outcomes as well as on training at various levels, including of Master and PhD students. Many projects report as the key performance measures the number of persons trained, the attendance of specialized courses, scientific seminars, workshops and publications. Some research groups in Sri Lanka such as those from IBMBB and the Chemical Research groups produced notable publications.

However, there is lack of patents and other intellectual property registered from most of the projects. This seems to be a principal draw back of the research design and research management. Sida/SAREC funds have been utilized first and foremost to carry out research projects and for building research capabilities and not to produce results designed as raw material for innovation. Some projects, funded for long periods of time, seem to have yielded more of innovation and durable results from an economic point of view. Examples could be taken from research projects related to health, agriculture and forestry. Moreover, Hué University of Agriculture and Forestry and its counterpart in HCM City have attained research results and developed educational programs with impact on agriculture.

(g) Governance and Control

In the case of Sri Lanka, the management of research programs and the related governance issues have been significant issues for the implementation of the Sida/SAREC-supported activities. There has been a lack of clear management control of disbursement of funds and also in the procedures for procurement of scientific and other equipment. Although some procurement of expensive devices was carried out by a specialized government agency in Sweden, the recipient institutions and individual scientists have had to deal with several administrative layers. For example the change of research administration roles from NSF of Sri Lanka to UGC for university researchers did not yield very positive outcomes. In a developing country context, administrative and financial barriers seem to be rampant.

In the case of Vietnam, these management and control issues seem to have been relatively better executed.

Our conclusion is that countries who receive development assistance must recognize that the utilization of such assistance should be made in the most effective and responsible manner. Proper governance of such assistance, including transparency, accountability and regular reporting, is under the responsibility of both the donor and the recipient. We are aware that Sida/SAREC has reacted to these and similar difficulties of governance and that it has changed some of its procedures for support. Vietnam provides a best example of scientific reformation and countries such as Sri Lanka must learn from the experience of Vietnam to revamp and revitalize their research system which is not so difficult to achieve if there is a political will and willingness on the part of scientists to commit to research excellence.

Part 7
Swedish Research Cooperation: Recommendations for the Future

What are the principal lessons learned and what recommendations for the future should be given the authorities and research communities and in the two developing countries? What issues in the development of their research capabilities are important to consider when developing new and more appropriate policies for their national research systems?

Furthermore, what structural issues in all three countries should be considered when managing future programs aimed at facilitating of research contacts between Sweden and the two developing countries? (For summaries of other observations and more detailed assessments, see the other sections of this document.)

Based on this project's analyses and other investigatory work (and on our on-the-ground fact-finding in Sri Lanka, Vietnam and Sweden), we would like to list the following ten recommendations for future Swedish research-related collaboration with Sri Lanka and Vietnam respectively.

i. Large projects

ii. Systemic approaches

iii. Strategic partnerships

iv. Risk taking

v. Clearly defined goals

vi. R&D with an innovation edge

vii. Focus also on innovation finance

viii. Structural adjustments and combinations of short-term and long-term project activities

ix. Talent scouting and pro-active recruitment

x. Public-private partnerships

Other specific lessons learned from the two recipient countries of Swedish support to R&D are listed elsewhere in the report.

(i) Large Projects

R&D projects in agriculture and in the health care sector in both Sri Lanka and Vietnam with a significant scale of funding seem to have been more successful than small projects in the same sector, possibly because large and complicated problems need large resources. Hence, significant scale of funding and the need for critical mass should be considered when addressing intricate, complicated problem areas.

(ii) Systemic Approaches

Science-based innovation need to be integrated into the wider socio-economic fabric to become effective in the short-term and in long-term. We encountered a number of examples in agriculture-related projects, where systemic approaches to the user-community offered original keys to success. By involving regular farmers – and whole farming communities – in project design, in researcher/user interaction, in experimental development and testing, these project approaches provided interactive tools for a real-world innovation system with an early socio-economic impact. Such approaches may also be successful when applied systematically also in other sectors.

(iii) Strategic Partnerships

It is our impression that the cooperation in research projects, which have succeeded particularly well in Sri Lanka and in Vietnam, is based on a combination of strong professional and personal linkages. Moreover, successful projects were developed with a strategic view to combine interests at both ends of the cooperation. Strategic partnerships need to be clearly defined, focused on mutual interests, which are understood well by the parties involved, and developed according to potential synergy effect. Goals are to be achieved not only by collaborative ways and means, but should also be complementary to the objectives of the research teams, other specialists involved and their institutions or organizations.

(iv) Risk Taking

In Sri Lanka and Vietnam, projects and activities which started as bold attempts or as visionary activities, mobilizing both local institutional support and strong personal commitments, seem to have succeeded well and survived economic, administrative and other practical problems. Good projects and effective R&D capacity formation must include risk taking and have funding that will allow for limited mistakes on the condition of continuous adjustments to errors. Examples of successful projects with a relatively open agenda to include also new and supplementary activities are the 'Buffalo Project' in Sri Lanka and several of the health care-related projects in Vietnam. More flexibility will be needed in the design and future implementation of research and experimental development projects and related innovative activities.

(v) Clearly Defined Goals

A number of projects that we have been looking into have general goals, which are difficult or sometime impossible to measure and evaluate. Vague goals for R&D make it unfeasible to determine success or failure. It may be difficult to formulate clear objectives, especially in the design of high-risk research projects, but attempts should always be made to specify the deliverables and other milestones as part of the design of planned projects and activities.

(vi) R&D with an Innovation Edge

Public-private partnerships to shape innovation environments related to R&D activities are common among the highly-industrialized countries, but rare in Sri Lanka and Vietnam. For example, only a few science and technology parks next to R&D institutions and universities in Vietnam have started to operate. Co-funding of public R&D by private business firms and foundations remains a very new phenomenon. However, in today's Vietnam we found a private-sector interest to engage in collaborative R&D and engineering projects aiming for innovation. To also engage business companies and other partners from the private sector in the country and from the outside, it is important to communicate the objective to translate the R&D results into new products and processes. Here, Sweden has a lot to offer. Role models could be taken from cooperative geological R&D and surveys in Vietnam and Sweden, where initial funding (e.g. for projects and the training of experts) was provided by SAREC, while the long-term sustainability of the capacities was funded or co-funded for many years by commercial agreements. Innovation achievements are also a measure of ultimate success. With a strong focus on usability and socio-economic impact, R&D projects supported by Sida/SAREC could also accommodate commercially viable services towards end-users, thereby possibly becoming economically more successful and sustainable in the long term.

(vii) Focus also on Innovation Finance

As the Asian countries are becoming significant destinations for international R&D investments, there is no corresponding expansion of funds to systematically exploit R&D as raw material for innovation. While still negligible in Sri Lanka and Vietnam, multinational R&D spending in Asia is becoming increasingly important, now being dispersed also to countries other than China, India, Singapore, etc. In this process, Sri Lanka and Vietnam will have to develop their own markets for innovation finance. To secure high socio-economic impacts of previous and on-going R&D funding by Sida/SAREC, the

Swedes could provide technical and other expertise to foster a development towards a risk capital market conducive to innovation across the sectors in society. Sweden's experiences in advancing its own venture capital market underline that the financing of science-based or high-tech innovation needs highly-skilled professionals, often with a professional background in research. Sida/SAREC could provide policy advice derived from Sweden's successful 'technology bridges' between R&D and innovation. R&D tax credits and government-supported venture funds may provide means to level the playing field.[15]

(viii) Combinations of Short-term and Long-term Project Activities

R&D is typically a long-term activity, but might also offer insights and expert knowledge used for quick solutions. It is our impression that the most successful projects, funded by Sida/SAREC in Sri Lanka and Vietnam, combine short-term and long-term activities, thereby creating an early, continuous stream of research results to the benefit of stakeholders which are engaged in projects during long periods of time. Significant change may need long-term commitments and a dedication to 'follow-through' until the main problems have been properly addressed, investigated and resolved. We encountered relatively autonomous projects given relatively short time spans, which might have succeeded better over a longer period or by being connected to another stream of research activities.

(ix) Talent Scouting and Pro-active Recruitment

The relatively large funding by Sida/SAREC of specialized education, training and other human resource development in both countries has mobilized academic and other talents. Some of the persons trained or otherwise engaged in Swedish-funded R&D have shown exceptional leadership skills, provided important advice to Sida/SAREC, helped in evaluations of projects and programs, and continued supporting Sida/SAREC activities in areas of expertise other than their own. It seems to us that some of the talented persons with a clear affiliation with the Swedes should be supported not only for skillful project and program leadership and for bringing organizations to scale and to world-class quality, while cooperating with institutions in Sweden. They could also be instrumental in further talent seeking and for creating wider networks of researchers and other experts in Sri Lanka and Vietnam to the benefit of Swedish R&D institutions and innovative companies. This is a practice used also by other country donors.

(x) Public-private Partnerships

From our interviews, it seems clear that both Sri Lanka and Vietnam are now relatively open to market-oriented approaches to the funding of R&D, even to private-public institution building and partnerships from abroad. Vietnam has already a handful of privately funded universities in operation. However, their R&D is weak or non-existent. Along with globalization, universities and other R&D institutions in Sweden are seeking strategic cooperation in research and higher education in developing countries. It would be wise for Swedish institutions and firms to benefit from the many years of R&D cooperation, when developing and deepening partnerships in Sri Lanka and Vietnam. At KTH, we were presented with plans for strategic academic venturing in Asia (China, Pakistan). There are already such options open for consideration in Sri Lanka as well as in Vietnam. In Vietnam, as the example, there are several private consortia behind the new universities actively seeking foreign direct investments in higher education and related R&D. Since a few years, taking just a country example from Vietnam, Australia's RMIT and other universities have their own university facilities and academic staff already operating in the South of Vietnam

[15] A supplementary observation: In the context of international competition, the two governments should avoid incentives to overcompensate foreign investors, which could lead to an Asian regional "race to the bottom". Cf. Ernst, Dieter & David M. Hart: "Governing the Global Knowledge Economy: Mind the Gap!" Paper prepared for the Conference on "Science, Technology and Innovation Policy", Georgia Tech, October 20, 2007

Abbreviations

ACCIMT	Arthur C. Clark Institute of Modern Technologies, Sri Lanka
AFTA	ASEAN Free Trade Area
ARTI	Agrarian Research and Training Institute, Sri Lanka
ASEAN	Association of Southeast Asian Nations
BRI	Building Research Institute, Sri Lanka
CARP	Council for Agricultural Research Policy, Sri Lanka
CEA	Central Environmental Authority, Sri Lanka
CIDA	Canadian International Development Agency, Canada
CIEM	Central Institute of Economic Management, Vietnam
CINTEC	Council for Information Technology, Sri Lanka
CISIR	Ceylon Institute for Scientific and Industrial Research, Sri Lanka
CRI	Coconut Research Institute, Sri Lanka
CTU	Can Tho University, Vietnam
EM Bnet	European Molecular Biology Network
FDI	Foreign Direct Investments
GDP	Gross Domestic Product
GERD	Gross National Expenditure on R&D
IBMBB	Institute of Biochemistry, Molecular Biology and Biotechnology, Sri Lanka
IDB	Industrial Development Board, Sri Lanka
IDRC	International Development Research Centre, Canada
IFS	Institute of Fundamental Studies, Sri Lanka
ISM	Institute of Science Management, Vietnam
ISPC	International Seminars in Physics and Chemistry
ITI	Industrial Technology Institute, Sri Lanka
JICA	Japan International Cooperation Agency, Japan
KTH	Royal Institute of Technology, Sweden
LCB	Linnaeus Centre of Bioinformatics, Sweden
MEKARN	Mekong Basin Animal Research Network
MOST	Ministry of Science and Technology, Vietnam
MRI	Medical Research Institute, Sri Lanka
NARA	National Aquatic Resources Agency, Sri Lanka
NARESA	Natural Resources Energy and Science Authority, Sri Lanka
NASTEC	National Science and Technology Commission, Sri Lanka

NERD	National Engineering Research and Development Centre, Sri Lanka
NGO	Non-Governmental Organization
NIAH	National Institute of Animal Husbandry, Vietnam
NISTPASS	National Institute for Science and Technology Policy and Strategy Studies, Vietnam
NLU	Nong Lam University, Vietnam
NRC	National Research Council, Sri Lanka
NSC	National Science Council, Sri Lanka
NSF	National Science Foundation, Sri Lanka
R&D	Research and experimental development
RMIT	Royal Melbourne Institute of Technology, Australia
RRI	Rubber Research Institute, Sri Lanka
S&T	Science and technology
SAREC	Sida's Department for Research Cooperation, formerly (1975–1995) the Swedish Agency for Research Cooperation with Developing Countries
SCST	State Commission for Science and Technology, Vietnam
SEK	Swedish Krona
Sida	Swedish International Development Cooperation Agency
SLINTEC	Sri Lanka Institute of Nano Technology, Sri Lanka
SLU	Swedish University of Agricultural Sciences, Sweden
TRI	Tea Research Institute, Sri Lanka
UGC	University Grants Commission, Sri Lanka
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
USD	United States Dollars
USSR	Union of Soviet Socialist Republics
WHO	World Health Organization

References

Sri Lanka

Dassanayaka, S. (2003). Technology, poverty and the role of new technologies in eradication of poverty: The case of Sri lanka. Paper presented at the South Asia Conference on Technologies for Poverty Reduction.

Davis, C. H. (1998). Research effectiveness and R&D evaluation in developing countries, Knowledge and Policy, 10(4), 7–30.

Dayaratne, P. (1997). Studies on the Puttalam/Mundel Esturaine System and Associated Coastal Waters. Colombo: National Aquatic Resources Research and Development Agency.

Department of Agriculture (2003) Rice Congress 2000: Future of Rice in Sri Lanka Second Leap Forward: Gannoruwa Proposals. Gannoruwa, Sri Lanka: Department of Agriculture.

Sagasti, Francisco. (2004). Knowledge and Innovation for Development the Sisyphus Challenge of the 21st Century, Cheltenham, UK: Edward Elgar.

Greenberg, A., & Sadowsky, G. (2002). Sida Supported ICT Projects at Universities and Research Organizations in Sri Lanka (No. Sida Evaluation02/17). Sweden: Swedish International Research Cooperation Agency.

Hettiarachchi, A. P., Dilrukshi, P. R. M. P., & Wickremasinghe, S. I. (2005). Gender Analysis of Engineering graduates passed out from Sri Lankan Universities. Paper presented at the Proceedings of the Sri Lanka Association for the Advancement of Science 61st Annual Session, Colombo.

IBMBB. (2007). Institute of Biochemistry, Molecular Biology and Biotechnology, Progress 2003–2006. Colombo: The University of Colombo.

Karunanayake, E. (2006). Two Decades of Capacity Building in Molecular Life Sciences in Sri Lanka. Colombo, Sri Lanka: Javana Graphics (PVT) Ltd.

Karunanayake, M. M. (Ed.). (2001). Poverty, Spatial Imbalances and Regional Planning in Sri Lanka Policies and Issues. Colombo: University of Sri Jayawardenepura.

Lindqvist, T. (Ed.). (2001). International Science Programme Uppsala University 1961–2001 – Historical Review and Participants' Experiences. Uppsala: Uppsala University.

NARESA. (1997). The SAREC/NARESA Buffalo Research Program. Sri Lanka: Natural Resources, Energy and Science Authority of Sri Lanka.

National Science Foundation – NSF. (2004). Towards Promoting the Development of Biotechnology Industries in Sri Lanka. Colombo: National Science Foundation.

Natural Resources, Enery and Science Autrhority of Sri Lanka, (1981).

NSF. (2006). Sri Lanka Science & Technology Statistical Handbook 2004. Colombo: National Science Foundation.

NSF. (2007a). National Survey of Research and Development in Sri Lanka 2004. Colombo: Science & Technology Policy Research Division, National Science Foundation, Sri Lanka.

NSF. (2007b). Sri Lanka Science and Technology Statistical Handbook 2004(2006). Colombo: National Science Foundation.

Pethiyagoda, R. (2006a). Making science work in Sri Lanka. Paper presented at the Proceedings of the Peradeniya University Research Sessions, Peradeniya, Sri Lanka.

Pethiyagoda, R. (2006b). Making science work in Sri Lanka. Paper presented at the Proceedings of the Peradeniya Unviersity Research Sessions, Peradeniya.

Planning, M. o. F. a. (2007). Mahinda Chintana: Vision for a New Sri Lanka. Colombo.

Samarajeewa, U. (2001). Reseach and Research Training in Sri Lanka 1991–2000. Colombo: University Grants Commission.

Sanderathe, N., & Nilsson, J. S. (1996). Sri Lankan-Swedish Research Cooperation. Stockholm: Sida/SAREC.

Silva, M. A. T. d., Yapa,G. & Silva E.D.de. (2002). Interactive peer review as a productive evaluation process. Research Evaluation, 11(3), 117–176.

Silva, M. A. T. d., Yapa,G. & Silva, E.D.de. (2004). Trends and shifts in institutional productivity: Natural products chemistry research in Sri lanka. 13(December 2004), 141–196.

The University Act, No 16 of 1978, LD-B21/78V C.F.R.

The University Grants Commission (1978). Annual Statistics, Colombo, Sri Lanka.

Thornstrom, C. G. (1989). Sri Lanka – Development of scientific research and SAREC's support 1976–1986. Stockholm: SIDA.

Tomson, G. (2005). Networks and Networking – reflection for the future. Paper presented at the Will we respond to antibiotic resistance in time?

University of Colombo. (2006). Institute of Boichemisrty, Molecular Biology and Biotechnology. Colombo.

University of Peredeniya. (2006). First International Conference on Industrial and Information Systems. Kandy: Faculty of Engineering. Sri Lanka.

Wickremasinghe, S. I., & Krishna, V. V. (2006). S&T policy and the Sri Lankan National System of Innovation: the role of public research systems. In Science and Technology Policy and Diffusion of Knowledge in Asia-Pacific Economies: Understanding the Dynamics of National System of Innovation", Paris: UNESCO.

Vietnam

ADB (2004). Cases of successful links between small-scale producers and markets. Hanoi: Asian Development Bank.

Agreement between the Government of the Socialist Republic of Vietnam and the Government of Sweden on Development, Hanoi 2004

Agreement on Continued Research Co-operation between the Government of Sweden and the Government of the Socialist Republic of Vietnam for the period 1 January 2004 to 31 December 2007, Hanoi 2003

Aubert, Jean-Eric (2005): Promoting innovation in developing countries: A conceptual framework, Washington: World Bank Institute (World Bank Policy Research Paper 3554).

Bezanson, Keith, Geoffrey Oldham (2000). Issues and options concerning a European foundation for research for development, Falmer: Institute of Development Studies.

Bezanson, Keith, Jan Annerstedt, Kunmo Chung, David Hopper, Geoffrey Oldham, Francisco Sagasti (1999). Vietnam at the crossroads: The role of science and technology, Ottawa: International Development Research Centre.

Bezanson, Keith. (2006). Some thought on the possibilities for science and technology for CIDA programming, Ottawa: CIDA.

Ca, Tran Ngoc, Thach Cann, Le Thanh Binh (2007). International cooperation in science and technology in Vietnam: Perspective on bioscience and biotechnology, Hanoi: Science and Technics Publishing House.

Can, Thach, Nguyen Thanh Ha, Tran Dinh Toan, Pham Kien Thiet. (2000). Comparative study if the impacts of donor-initiated research programme on research capacity in the south: The case of Vietnam, Hanoi: DGIS

Cann, Tran Ngoc Thach, Nguyen Thanh Ha, et al. (2000). Comparative study of the impacts of donor-initiated research programme on research capacity in the South: The case of Vietnam. Hanoi, DGIS.

CIEM/UNDP (2006). Survey's result report on technological innovation of industrial firms in Vietnam. Hanoi, Central Institute of Economic Management & United National Development Program.

Clow, David (1994). SAREC Library Support Programme in Vietnam: Evaluation and Review, Stockholm: Sida.

Forss, Kim (2006). Research cooperation between Vietnam and Sweden. Stockholm, Sida/SAREC (Sida Evaluation 02/06).

Göhl, Bo, and Nguyen. Thanh. Ha (1990). Vietnam: Development of scientific research and SAREC's support 1976–1989. Stockholm, SAREC Research Service 1990:2.

Hai, Nguyen Viet (2006). Outlines of the current status and development oprientation of Hoa Lac High-Tech Park in the near future. Hanoi: Hoa Lac High-Tech Park Management Board.

Hanoi Medical University & Karolinska Institutet. (2003). Health Systems Research Programme in Vietnam: Strengthening research capacity. Hanoi: Hanoi Medical University.

Hanoi University of Technology (2006). Center for Research and Consulting on Management: CRC Technology Business Incubator. Hanoi, Hanoi University of Technology.

Hieu, Luu Trong, Le Viet Ly, et al. (1991). Intensifying livestock and fuel production in Vietnam by making better use of local resources. Hué, Hué University of Agriculture and Forestry.

Hieu, Luu Trong [no date]. Agricultural production in Vietnam and the contribution of the Swedish University of Agricultural Science in human resource development on sustainable agriculture in Vietnam and South East Asia. Ho Chi Minh City, University of Agriculture and Forestry.

Hieu, Luu. Trong (2003). Sustainable livestock production on local feed resources. Ho Chi Minh City, University of Agriculture and Forestry.

Honda Foundation [no date]. Linking innovation and entrepreneurship for developing countries, Honda Foundation.

Hué University of Agriculture and Forestry [several years]. Annual and other progress reports on Sida/SAREC-funded projects. Hué, Hué University of Agriculture and Forestry.

KI [several years]. Annual (and other) progress reports from research cooperation between Karolinska Institutet and Vietnamese partners through SAREC-funded projects. Stockholm, Karolinska Institutet.

KI (2006). Contributing to global health 1986–2006. Stockholm, Karolinska Institutet (KI): Karolinska International Research and Training Committee (KIRT).

Lansang, Mary Ann, and Anders. Björkman (1995). Evaluation of SAREC's support for health research in Vietnam. Stockholm, SAREC.

Ly, Le. Viet, and Luu Trong Hieu (2003). Contribution to the establishment of a sustainable animal production in Vietnam. Hanoi, National Institute of Animal Husbandry.

MOST (2006). Hoa Lac Hi-Tech Park: Think high, aim high. Hanoi, Ministry of Science and Technology.

MOST/SAREC (2004). Vietnam-Sweden research cooperation programme 2004–2007: Guidelines of the Research Fund. Hanoi, Ministry of Science and Technology & SAREC.

NCSTP (2006). National Council for Science and Technology Policy. Hanoi, National Council for Science and Technology Policy.

Nörlund, Irene, Han Manh Tien, Tran Minh Thi (2007). Mid-term review of research cooperation Vietnam-Sweden 2004–2007, Hanoi/Stockholm: Sida/SAREC.

Prime Minister's Office (2001): Government Decree on the Issuance of the Regulation on the Management and Utilization of Official Development Assistance, Hanoi 2001

Román, Lisa. (1999). Research in Vietnam. Stockholm, Sida/SAREC.

Sagasti, Francisco (2006). Building science, technology and innovation capacities in developing countries: Notes on the possible role of the Canadian International Development Agency. Ottawa: CIDA.

SCIRD (2006). Science and Technology Competitiveness Indicators in ASEAN, Vol. 1 & 2. Seoul, Science and Technology Policy Institute of Korea (STEPI) & ASEAN Sub-Committe on Science and Technology Infrastructure and Resources Development (SCIRD).

SHTP (2007). Saigon Hi-Tech Park. Ho Chi Minh City.

Sida/SAREC [1976–2006]. Insatspromemoria and other documents in support of planning and decision-making on Swedish research cooperation with Sri Lanka and Vietnam. Stockholm, Sida/SAREC.

Sida/SAREC (2005). Research capacity: Towards the Millennium Development Goals, Stockholm: Sida/SAREC.

Sida/SAREC (2007). Sida's assessment of the research cooperation with Vietnam 2004–2007. Stockholm, Sida/SAREC.

Sida/SAREC [1976–2006]. Annual reports and other progress reports from research cooperation between Swedish and Vietnamese partners funded by Sida/SAREC. Stockholm, Sida/SAREC.

Sinh, Bach Tan (2004). Transformation of Vietnam's national system of innovation: The case of organizational and policy learning in the industrial technology R&D institutes, Hanoi: NISTPASS.

Tam, Duong. Minh. (2006). The creation and development of high-tech parks in Vietnam: Approaches for regional science-technology space. HCM City, Ho Chi Minh City High-Tech Park.

Tuan, Pham Minh Tuan, P. M. (2006). CRC-TOPIC: One of four globally highlighted incubators selected by the World Bank. Hanoi, Hanoi Institute of Technology.

Tung, Nguyen. Thanh (2006). Development of science and technology parks in Vietnam: Strategic objectives, conceptualization, models and basic requirements for the establishment and development. Hanoi, NISTPASS.

World Bank (1998). World development report: Knowledge for development, Washington: Oxford University Press.

Persons Interviewed and in Meetings with the Investigators

Sri Lanka

Dr (Mrs) S.I. Abeygunawardena, University of Kelaniya. Department of Microbiology

Dr Aruna Gunawardena, University of Peradeniya. Faculty of Engineering

Dr Champa Amarasiri, National Aquatic Resources Agency

Dr D.L. Jayaratne, University of Kelaniya, Department of Microbiology

Dr Dilhan Balage, University of Peradeniya. Faculty of Engineering

Dr Disala Uduwawela, University of Peradeniya. Faculty of Engineering

Dr Geethika Yapa, National Science Foundation

Dr Indira D. de Silva, University of Peradeniya. Faculty of Veterinary Medicine

Dr KPA Seneratne, Deputy Director, Industrial Technology Institute, Colombo.

Dr Lakshmi S.R. Arambewela, Industrial Technology Institute

Dr Lilantha Samaranayake, Department of Electrical Engineering, University of Peradeniya.

Dr Lilantha Samarathunga, University of Peradeniya, Faculty of Engineering

Dr M.C.N. Jayasuriya, Director, National Science Foundation

Dr R. D. Gunaratne, National Science & Technology Commission

Dr Renu Wickramasinghe, University of Kelaniya, Department of Parasitology

Dr Ruwan Weerasinghe, University of Colombo, ICT

Dr S.A.V.Moorthy, National Science Foundation

Dr Samath D Dharmaratne, Department of Community of Medicine, University of Peradeniya.

Dr Sanath Alahakoon, University of Peradeniya. Faculty of Engineering

Dr Seetha Wickramasinghe, National Science Foundation

Dr Senarath Dissanayake. Department of Archeology

Dr Tissa Vitharana, Minster of Science and Technology

Dr V. Kumar, University of Peradeniya. Department of Chemistry

Dr W.M.A.D.B. Wickramasinghe, Rice Research & Development Institute, Batalagoda

Dr W.M.W. Weerakoon, Rice Research & Development Institute, Batalagoda

Dr Wasantha Amradasa, National Science Foundation

Dr Wijaya Jayatillake, University of Peradeniya. Faculty of Agriculture

Dr. Aresha Manamperi, University of Colombo. Department of Parasitology

Dr. B.G.D.N.K. de Silva, University of Sri Jayawardenepura. Department of Zoology, Faculty of Science

Dr. D.M. Deepthi Yakandawala, University of Peradeniya. Department of Botany

Dr. D.S.A. Wijesundera, National Botanical Gardens, Peradeniya

Dr. G.A.U. Jayasekera, University of Colombo. Department of Plant Sciences

Dr. H.A.C. Hapuarachchi, University of Colombo. Department of Parasitology

Dr. Manjula Fernando, University of Peradeniya. Faculty of Engineering

Dr. N.S. Gunawardene, University of Kelaniya. Faculty of Medicine

Dr. O.V.D.S.J. Weerasena, University of Colombo. IBMBB

Dr. P. V. Randeniya, University of Colombo. Department of Zoology

Dr. Preminda Samaraweera, University of Peradeniya, Department of Molecular Biology and Biotechnology

Dr. R.P.V.J. Rajapakse, University of Peradeniya. Department of Veterinary Pathobiology

Dr. Ranil Samantha Dassanayake, University of Kelaniya. Faculty of Medicine

Dr. Renu Wickremasinghe, University of Sri Jayawardenepura. Faculty of Medicine

Dr. Rupika Rajakaruna, University of Peradeniya. Department of Zoology

Dr. S.N.Surendran, University of Jaffna. Department of Zoology

Dr. Sarath R. Sirimanne, University of Colombo.

Dr. Sharmila Jayasena, University of Colombo, Department of Biochemistry and Molecular Biology

Dr. Sulochana Wijesundera, University of Colombo. Department of Biochemistry and Molecular Biology

Dr. V.A. Sumanasinghe, University of Peradeniya. Department of Agricultural Biology

Dr. Vajira H.W. Dissanayake, University of Colombo. Department of Anatomy

Dr. W.Abeyewickreme, University of Kelaniya. Department of Parasitology

K.B. Ranawana, University of Peradeniya. Department of Zoology

M. Karunanithy, Eastern University, Trincomali Campus

Mr Asoka T. de Silva, Free Lance Consultant

Mr Goran Schill, Swedish Embassy, Colombo

Mr J. Ranatunga, National Engineering Research & Development Center

Mr S. Wijeratne, University of Ruhuna. Department of Geography

Mr. K.G.G. Wijesinghe, Cinnamon Research Station, Thihagoda

Mr. R. Ramesh, Medical Research Institute

Ms Anusha Amarasinghe, National Science Foundation

Ms P.G.P. Abeyratne, Ministry of Science & Technology

Ms R. Wijeratne, National Science Foundation

Ms S Devarajan, National Science Foundation

Ms W. Seneviratne, Open University

Ms. C. Fonseka, National Science Foundation

Ms. K.A.K.C. Kulatunga, Medical Research Institute

Ms. W.A.S. Wijendra, Medical Research Institute

Ms. Y.J.P.K. Mithrasena, Department of Agriculture, Bombuwala

Ms. Y.L.P. Jayananda, University of Peradeniya. Department of Veterinary Pathobiology

Prof C. Bogahawatte, University of Peradeniya. Faculty of Agriculture

Prof E H. Karunanyake, University of Colombo, IBMBB and NRC.

Prof M.T.M. Jiffrey, University Grants Commission

Prof Upali Vidanapathirana, Open University

Prof. (Miss) P.R.T.Cumaranatunga, University of Ruhuna. Department of Fisheries Biology

Prof. H Abeywardena, Vice Chancellor, University of Peradeniya

Prof. H.J. de Silva, University of Kelaniya. Faculty of Medicine

Prof. Kamani Tennakoon, Director, IBMBB, University of Colombo.

Prof. N.R. de Silva, University of Colombo. Department of Parasitology

Prof. C.S Weeraratne, Chairman, Sugar Research Institute, Colombo

Prof. S. Widanapathirana, University of Kelaniya.Department of Microbiology

Prof. V. Karunaratne, University of Peradeniya. Faculty of Science. Department of Chemistry

Professor Anura Wickremasinghe, Department of Chemistry, University of Peradeniya.

Professor K.S. Walgama, Director Academic Affairs, University of Peradeniya.

Professor Kapila Goonasekere, University of Peradeniya.

Dr. Sarath Abeysinghe, Biochemistry Division, IFS

Dr. H.M.T.B Herath, Department of Agriculture

Dr. K.A.N.P. Bandara, Entomology Division, Dept of Agriculture.

Vietnam

An, Pham Nhat, (Dr.), Hanoi Medical University & National Hospital of Pediatrics, Hanoi

Björkman, Ola, (Dr.), Stockholm Bioscience

Ca, Tran Ngoc, (Dr.), Vice President, NISTPASS

Cam, Phung Dac (Dr.), National Institute of Hygiene and Epidemiology, Hanoi

Can, Thach, (Mr.), Ministry of Science and Technology

Carlsson, Barbro, (Dr.), Sida/SAREC, Stockholm

Chuc, Nguyen Thi Kim, (Dr.), Hanoi Medical University

Cong, Nguyen Van, (Mr.), University of Agriculture and Forestry (NLU), HCM City

Cuong, Dam Viet, (Dr.), Health Strategy and Policy Institute, Ministry of Health, Hanoi

Dalin, Per, (Mr.), Schmidt Vietnam

Dam, Vu Cao, (Dr.), Vietnam National University, Hanoi

Diwan, Vinod K., (Dr.), KIRT, Karolinska Institutet

Do Quang Huy, (Mr.), Delegation of the European Commission to Vietnam

Doanh, Le Dang, (Dr.), Central Institute of Economic Management (CIEM)

Duong, Pham Dai, (Mr.), Hoa Lac High-Tech Park

Ha, Mai, (Dr.), NISTPASS

Ha, Nguyen Thanh, (Mr.), NISTPASS

Ha, Pham Nguyen, (Mr.), Embassy of Sweden, Hanoi

Ha, Pham Thi Bich, (Ms.), NISTPASS

Hai, Nguyen Viet, (Dr.), Hoa Lac High-Tech Park

Hai, Nguyen Viet, (Mr.), Hoa Lac High-Tech Park

Hieu, Luu Trong, (Dr.), University of Agriculture and Forestry (NLU), HCM City

Hjortlund, Preben, (Mr.), Hanoi International Technology Center, Schmidt Vietnam

Hoc, Nguyen Van, (Dr.), NISTPASS

Hung, Nguyen Vo, (Mr.), NISTPASS

Huong, Dao Lan, (Dr.), Health Strategy and Policy Institute, Ministry of Health, Hanoi

Ke, Nguyen Ba, (Dr.), Ministry of Construction & Fecon Foundation Engineering and Underground Construction, Hanoi

Khang, Duong Nguyen, (Dr.), University of Agriculture and Forestry (NLU), HCM City

Khe, Nguyen Chanh, (Dr.), Saigon High-Tech Park

Kulkarni, S. T., (Mr.), IBM Vietnam

Lam, Le Tran, (Dr.), Hanoi Department of Science and Technology

Lan, Huynh Ba, (Dr.), University of Economics and Finance, HCM City

Larsson, Mattias, (Dr.), Karolinska Institutet, Hanoi & Stockholm

Loc, Do Van, (Dr.), Ministry of Science and Technology

Long, Phung Duc, (Dr.), WSP Vietnam, Hanoi

Luan, Ngo Tran, (Dr.), University of Economics and Finance, HCM City

Mai, Nguyen Dinh, (Mr.), Saigon High-Tech Park

Mai, Nguyen Thi Phuong (Ms.), NISTPASS

Man, Ngo Van, (Dr.), University of Agriculture and Forestry (NLU), HCM City

My, Le Thi Thanh, (Dr.), Saigon High-Tech Park

Nga, Le Thu, (Ms.), Advance Associates Ltd., Hanoi

Ngoan, Le Duc, (Dr.), Hué University of Agriculture and Forestry

Nha, Chu Tuan, (Dr.), President, National Council for Science and Technology Policy (former Minister of Ministry of Science and Technology)

Oanh, Tran Thi Mai, (Ms.), Health Strategy and Policy Institute, Ministry of Health, Hanoi

Ottosson, Mats, (Mr.), Embassy of Sweden, Hanoi

Quang, Han Nhat, (Mr.), IBM Vietnam

Quy, Le Thi, (Dr.), Research Center for Gender and Development, Hanoi University of Social Sciences and Humanities

Scott, Pam, (Dr.), DBM Vietnam Ltd., HCM City

Shangpliang, Lon Scandy, (Mr.), IBM Vietnam

Skår, John, (Dr.), Stategy and Development Office, Karolinska Institutet

Tam, Duong Minh, (Dr.), Saigon High-Tech Park

Thang, Le Duc, (Dr.), HAAI Ltd., Hanoi

Thinh, Dang Duy, (Dr.), Vice-President, NISTPASS

Tien, Le Dinh, (Dr.), Vice Minister, Ministry of Science and Technology

Tien, Nguyen Truong, (Dr.), Advance Associates Ltd., Hanoi

Tien, Tran Dung, (Mr.), Ministry of Science and Technology

Tien, Tran Dzung, (Mr.), Ministry of Science and Technology

To, Nguyen Thi, (Dr.), Ministry of Education and Training

Tomson, Göran, (Dr.), Karolinska Institutet

Truc, Pham Chanh, (Mr.), Saigon High-Tech Park

Trung, Le Quang, (Mr.), Saigon High-Tech Park

Truong, Pham Ngoc, (Mr.), Ministry of Science and Technology

Tuan, Nguyen Minh, (Mr.), IBM Vietnam

Tuan, Pham Minh, (Mr.), Hanoi Institute of Technology

Tung, Nguyen Thanh, (Mr.), NISTPASS

Tuong, Nguyen Van, (Dr.), Hanoi Medical University

Vinh, Nguyen Nhu, (Mr.), Hoa Lac High-Tech Park

Annex 1 Sri Lanka Tables

Table 1: The distribution of academic staff at universities in Sri Lanka (2005)

University/Faculty		Professor	Assoc. Professor	Senior Lecturer	Lecturer Prob. Lecturer	Academic support staff	Total
	Arts	14	11	57	34	32	148
	Education	1	4	13	10		28
	Law		1	9	10	1	22
	Medicine		25	5	47	45	124
Colombo	Science		12	2	52	21	
	Management			1	27	18	46
Sri Palee Campus				1	11		12
Total		**52**	**24**	**206**	**149**	**36**	**467**
	Arts	22	12	93	52		179
	Agriculture	22	1	55	26	31	135
Peradeniya	Dental Science	6		29	27		62
	Vet. Science	5		16	19		40
	Engineering	8	1	42	29	30	110
	Medicine	13	4	40	35		92
	Science	25	3	39	22		89
Total		**101**	**21**	**314**	**210**	**61**	**707**
	Arts	11	6	51	30	8	106
	Applied Science	13	2	45	14		74
Sri Jayewardenapura	Management	2	1	73	55		131
	Medical Science	14	2	32	49		97
Total		**40**	**11**	**201**	**148**	**8**	**408**
	Humanities	5	5	45	19		74
	Social Sciences	4	4	47	20		75
Kelaniya	Science	8	9	50	25		92
	Medicine	11	2	38	38		89
	Commerce&Mgt			21	23		44
Total		**28**	**20**	**201**	**125**	**0**	**374**

University/Faculty		Professor	Assoc. Professor	Senior Lecturer	Lecturer Prob. Lecturer	Academic support staff	Total
	Architecture	4		24	11		39
Moratuwa	Engineering	23	4	90	48	2	167
	Information technology			4	3		7
Total		**27**	**4**	**118**	**62**	**2**	**213**
	Arts	7	8	54	30	20	119
	Medicine	3		9	12		24
Jaffna	Science	3		23	31	6	63
	Agriculture		2	8	10	1	21
	Management			11	14		25
Vavuniya Campus	Applied Science			4	8	2	14
	Business Studies			3	6		9
Total		**13**	**10**	**112**	**111**	**29**	**275**
	Agriculture	8	2	14	31	3	58
	Humanities&Social Sci.	5	3	43	25	3	79
	Medicine	11		33	35	4	83
Ruhuna	Engineering			9	30		39
	Science	5	1	43	35		84
	Management & Finance			11	12		23
Total		**29**	**6**	**153**	**168**	**10**	**366**
	Agriculture	2		9	15		26
	Science			11	19	1	31
Eastern	Arts & Culture		2	11	18		31
	Commerce			8	7		15
Trincomalee Campus	Communic. & Business			4	5		9
Total		**2**	**2**	**43**	**64**	**1**	**112**
	Arts&Culture			10	18		28
South Eastern	Commerce&Mgt			5	18		23
	Applied Sciences			1	16		17
Total				**16**	**52**		**68**
	Humanities&Social Sci.	1		7	9		17
Rajarata	Applied Sciences	2		7	5		14
	Agriculture	1		2	5		8
	Management			5	10		15
Total		**4**		**21**	**29**		**54**
	Social sciences	2		13	22	10	47
	Business			7	13		19
Sabaragamuwa	Geomatrics			2	10	8	20
	Agriculture		1	6	19	3	29
	Applied Science	2	1	6	21	22	52
Total		**4**	**2**	**34**	**84**	**43**	**167**

University/Faculty		Professor	Assoc. Professor	Senior Lecturer	Lecturer Prob. Lecturer	Academic support staff	Total
	Agriculture	3		7	10		20
	Applied Science			6	20	1	27
Wayamba	Business			3	9		12
	Livestock, Fisheries, Nutrition			2	14		16
Total		**3**		**18**	**53**	**1**	**75**
	Natural Science	6		35	12	30	83
	Education	1	1	8	10	4	24
Open Univ.	Engineering	3		36	14	12	65
	Humanities	4		22	20	13	59
	Regional Edu. Service					21	21
Total		**14**	**1**	**101**	**56**	**80**	**252**
Higher Educational Institutes		7	2	95	72	53	229
Grand Total		**324**	**103**	**1633**	**1383**	**324**	**3767**

Source: University Grants Commission, Colombo, Various Years

Table 2: National Expenditure on Research and Development by Source of Funds, 2004, LKR million

Source of Funding	Recurrent	Capital	Total
Government	2,115.3	456.0	2,571.3
	(55.6%)	(12.0%)	(67.5%)
Private	17.1	4.7	21.9
	(0.5%)	(0.1%)	(0.6%)
Foreign	675.7	186.2	861.8
	(17.7%)	(4.9%)	(22.6%)
Other	276.4	76.1	352.5
	(7.3%)	(2.0%)	(9.3%)
Total	**3,084.5**	**723.0**	**3,807.5**
	(81.0%)	(19.0%)	(100.0%)

Source: R&D Survey 2004, National Science Foundation, Colombo, Sri Lanka

Table 3: R&D manpower availability in Sri Lanka, 2004.

Discipline	R&D Scientists (Full Time Equivalent)				S&T Scientists				Research Intensity FTE /S&T		
	M	F	T	%F	M	F	T	F	M	F	T
Natural Sciences	445	285	730	39.0	1,170	852	2,022	42	38	33	36
Engineering & Technology	625	148	773	19.1	3,658	453	4,311	11	17	33	18
Medical Sciences	124	115	239	48.1	421	363	784	46	29	32	30
Agricultural Sciences	394	180	574	31.4	885	357	1,242	29	44	50	46
Social Scienes and Humanities	167	109	276	39.5	842	511	1,353	38	19	21	20
Other	63	24	87	27.6	161	73	234	31	39	32	37
Total	**1,818**	**861**	**2,679**	**32.1**	**7,137**	**2,609**	**9,946**	**26**	**25**	**33**	**27**

M=male; F=female; T=total

Source: National R&D Surveys, 2004, National Science Foundation, Colombo, Sri Lanka

Table 4: R&D expenditure by source of funds in Sri Lanka, 1984–2004, LKR million

Source of Funding	1984	1996	2004
Government	239.4	981.0	2,571.3
	(93.2%)	(69.6%)	(67.5%)
Private	17.4	21.5	21.9
	(6.8%)	(1.5%)	(0.6%)
Foreign	-	324.5	861.8
		(23.0%)	(22.6%)
Other*		82.6	352.5
		(5.9%)	(9.3%)
Total	**256.8**	**2,647.7**	**3,807.5**
	(100.0%)	(100.0%)	(100.0%)

Sources: National R&D Survey Sri Lanka 1996 (NARESA) & 2004 (NSF)

*Other: funds generated by the institution itself by providing services etc.

Table 5: Employment rate of S&T graduates in Sri Lanka, 1999–2005

Year of Survey	1999*	2001	2003	2004	2005
Year of graduation	**1997**	**1998/99**	**2000/01**	**2002**	**2003**
Employed	89.1	78.0	61.0	71.5	92.9
Engaged in further education only	4.5	3.0	3.6	5.5	1.5
Self-employed	**	1.0	2.3	3.3	1.1
Unemployed	5.7	14.6	30.5	19.7	4.5
Not Specified	0.7	3.4	2.6	-	-
Total	**100**	**100**	**100**	**100**	**100**

Sources: Reports of Tracer study of S&T Graduates passed out from the Universities in Sri Lanka conducted by the NSF in 2001, 2003, 2004 and 2005.

* Reports of Tracer study of S&T Graduates passed out from the Universities in Sri Lanka by the Ministry of Science and Technology, 1999.

Table 6: Allocations by Sida/SAREC for the Electrical Engineering Project at Peradeniya University

Agreement Phase	Year	Funds/SEK ('000)	Total Grant/SEK ('000)
Phase I	1995	1300	**2650**
	1996	1350	
Phase II	1997	2400	**7650**
	1998	2650	
	1999	2600	
Phase III	2000	3000	**7000**
	2001	2000	
	2002	2000	
Phase IV	2003	650	**8293**
	2004	1845	
	2005	2120	
	2006	2089	
	2007	1589	

Source: Sida/SAREC Progress Reports, University of Peradeniya, Sri Lanka

Table 7: Key local researchers involved in the Electrical Engineering Project at Peradeniya University

Name	Degree/s obtained through Sida Collaboration	Institute registered	Currently in
1. Manjula Fernando	Tech. Lic./Ph.D.	KTH/CTH	UPeradeniya Faculty
2. Mathini Sellathurai	Tech. Lic.	KTH	*Left for UK*
3. Sanath Alahakoon	Ph.D.	KTH	UPeradeniya Faculty
4. Peethamparam Anpalahan	Tech. Lic.	KTH	*Left for UK*
5. Dinesh Pamunuwa	Ph.D.	KTH	*Left for UK*
6. Disala Uduwawala	Tech. Lic./Ph.D.	KTH	UPeradeniya Faculty
7. Chandima Ekanayake	Tech. Lic.	CTH	UPeradeniya Faculty
8. Sanath Wijayatilake	M.Phil.	UP	Working for CEB
9. Kamal Mularachchi	M.Phil.	UP	Working for CEB
10. Lakshitha Weerasinghe	M.Phil.	UP	Working for CEB
11. Lilantha Samaranayake	Tech. Lic./Ph.D.	KTH	UPeradeniya Faculty
12. Hemantha Rajamanthri	M.Phil.	UP	Working for CEB
13. Nilanga Abeywickrama	M.Sc./Ph.D.	CTH	Studying at CTH
14. Thilakasiri Vijayananda	M.Sc.	UP	Working for CEB
15. Roshan Weerasekara	Ph.D.	KTH	Studying at KTH
16. Nalin Harischandra	Ph.D.	KTH	Studying at KTH
17. Dilhan Balage	M.Sc.	UP	Studying at UPeradeniya

Source: Sida/SAREC Progress Reports, University of Peradeniya, Sri Lanka

Table 8: Summary list of publications from the Electrical Engineering Project at Peradeniya University, 1994–2006

Category	95	96	97	98	99	00	01	02	03	04	05	06	Total
Ph.D. Thesis	0	0	0	0	1	1	0	0	1	0	0	3	**6**
Tech. Lic Thesis	0	0	2	0	0	0	1	0	2	1	0	0	**6**
Journal Papers (Local & International)	0	0	1	0	3	2	0	0	1	0	0	2	**9**
Conference Papers (Local & International)	1	3	7	6	4	9	3	14	18	12	10	7	**94**
Internal Reports	1	1	1	0	4	0	1	0	0	0	0	0	**8**
Books/Chapters	0	0	0	0	0	2	0	0	0	3	2	0	**7**
Workshops/Seminars/Short Courses	0	1	1	0	1	1	4	0	0	0	0	0	**8**

Source: Sida/SAREC Progress Reports, University of Peradeniya, Sri Lanka

Annex 2 Sida/SAREC funds allocated to Sri Lanka, 1976–2006

Funding period	Area	Project	Counterpart in Sri Lanka	Counterpart in Sweden	Budget amount (SEK)	Abstract/Results
1976–1979	Social Sciences & Humanities	National Planning: "Patterns of self-reliant development in Sri Lanka"	MARGA Institute, Colombo		800 000	**Abstract:** According to the original plans the research program was to consist of three parts: studies of development of welfare and economic growth; employment and self-reliant development strategies; socio-economic factors at micro-level that affect people's participation in planning. **Results:** 12 publications, 8 scientific and 4 policy considerations.
1977–1982	Other	Support through the National Science Council	National Science Council, Sri Lanka		02 200 000	**Abstract:** The NSC was the then formal body for coordination of national research. The first grant for the period 1977 to 1979 was given to NSCs research fund as general support. The second grant was given for the period 1979 and 1981 for specified purposes, following the proposal of the NSC. Both grants were mainly used for the purchase of scientific equipment. **Results:** Liver disease project. Plant virology project. Algae ecology project. Electronic repair workshop. Glass blowing units.
1977–1982	Natural Resources & Environment	Support to the Agrarian Research and Training Institute	Agrarian Research and Training Institute, Sri Lanka		1 800 000	**Abstract:** The objectives of the Institute were to conduct agrarian research, provide training to public officers, members of local institutions and farmers and serve as a centre for the collection of information on agrarian problems. The support from SAREC was mainly used for staff development and post-graduate training... **Results:** Five scientists received their MA/MSC degrees through studies at universities in GB, USA and Australia mainly in the fields of sociology/anthropology, agricultural economics and communication studies. Two scientists received their PhD degrees.
1982–1996	Natural Resources & Environment	The Water Buffalo Research Program	University of Peradeniya, Faculty of Veterinary Medicine and Animal Science.	Swedish University of Agricultural Sciences (SLU). Department of Obstetics and Gynaecology.	9 011 000	**Abstract:** In the international debate the water buffalo was considered as a neglected animal with a great potential for draught and dairy in developing countries. Sri Lanka had approximately 750 000 water buffalos which are important for draught and for producing milk and meat. By late 1985 a small research farm at Mawela went into full operation. In building up the farm SAREC financed mainly the purchase of animals, field laboratory and other clinical facilities. A large research farm at Narangalla Estate was also established financed by local authorities, although SAREC agreed to finance purchase of scientific equipment and animals. The main objective was to make possible an introduction of improved water buffalo farming systems by application of the results obtained in previous research projects. The program would also further strengthen the capacity of Peredeniya University in the breeding and reproduction, physiology and nutrition, management and utilization of water buffaloes in Sri Lanka. **Results:** 1985 research farm at Mawela went into full operation. SAREC financed mainly the purchase of animals, fieldlaboratory and other facilities. Comprehensive dissemination of knowledge regarding efficient economical use of buffaloes.

Funding period	Area	Project	Counterpart in Sri Lanka	Counterpart in Sweden	Budget amount (SEK)	Abstract/Results
1984–1988	Natural Resources & Environment	Fresh Water Fishing Program	Ruhuna University College, Department of Zoology.	Institute of Freshwater Research of the National Swedish Board of Fisheries.	2 231 000	**Abstract:** The inland fisheries research program originates from a technical contact established between Department of Zoology, University of Ruhuna and the Institute of Freshwater Research in Sweden. By 1983 the two institutions proposed a joint research program on the fisheries potential in highland streams and lowland reservoirs in Sri Lanka. The program aimed at mapping stock and composition of fish fauna including the ecological and limnological background in selected areas of the country. SAREC funds have been used to finance staff, fishing test equipment and some laboratory equipment. Some parts of the project continued within the Marine Science Program. **Results:** 15 publications and three MSc.
1989–1996	Basic Science & Technology	Molecular Biology and Gene Technology Program	University of Colombo, Faculty of Medicine.	University of Uppsala. Department of Medical Genetics. International Science Programs (ISP).	4 354 000	**Abstract:** The aim of the program was to establish a molecular biology and gene technology department in the Faculty of Medicine at the University of Colombo. Two areas were identified as of primary importance: training to MSc and PhD levels, and research on filariasis. A laboratory for molecular biology – the first in the country – was established. Research and development in molecular biology and gene technology of relevance to the country have been conducted. Among results can be mentioned that specie-specific DNA probes for three filarial nematodes have been developed. **Results:** A laboratory for molecular biology – the first in the country – was established. Research and development in molecular biology and gene technology of relevance to the country have been conducted. Among results can be mentioned that specie-specific DNA pro
1997–2007	Basic Science & Technology	Biotechnology	University of Colombo, Department of Biochemistry & Molecular Biology. Department of Physiology. Department of Botany.	Uppsala University. Biomedical Centre. Stockholm University, Arhenius Laboratories.	17 650 000	**Abstract:** The aim of this program was to expand the critical mass of researchers in the field of biotechnology while building on the capacity created under an earlier Sida supported project in the field of molecular biology during the preceding seven years. Many areas and industries are in need of qualified staff in the field of biotechnology, like the biotech industry, food processing and preservation, environmental protection, agricultural and plant sciences and microbial extraction of minerals. Two areas have been identified as of primary importance; training of manpower resources to MSc and PhD level and research and development in the field of medicinal, agricultural and food biotechnology. One component of the program dealt with the mosquito borne disease human lymphatic filariasis for the development of new drugs. Other research projects include studies on genetic diseases, tuberculosis, malaria and breast cancer. **Results:** 2003: 15 PhD and 38 MSc. The project on molecular biology was assessed to be the most successful project in the 1996 independent evaluation of Sida research cooperation with Sri Lanka.

Funding period	Area	Project	Counterpart in Sri Lanka	Counterpart in Sweden	Budget amount (SEK)	Abstract/Results
1987–1994	Social Sciences & Humanities	Settlement Archeology	Post Graduate Institute of Archeology (PGIAR), University of Kelaniya.	Swedish Central Board of Antiquities (RAÄ)	5 408 000	**Abstract:** The Post Graduate Institute of Archaeology (PGIAR) was established in 1986 with the purpose of creating a centre for archaeological education, training and research. The government of Sri Lanka thereby showed the country's ambition to strengthen and develop humanistic research, with special reference to archaeology. The new archeological research is meant to cover the complete social structure, with an emphasis on identification and analysis of old settlements and their relationship with each other and with the environment.
1987–1994	Social Sciences & Humanities	Federalism and development	International Centre for Ethnic Studies (ICES), Colombo		1 231 000	**Abstract:** The project aimed at monitoring and analysing the recent government decisions to federalize certain state activities in Sri Lanka such as foreign aid, police and revenue use. The project studied this process using examples from selected provinces.
1989–2007	Natural Resources & Environment	Biological and ecological coastal marine science program	National Aquatic Resources Agency (NARA).	Stockholm University. Department of Zoology. National Board of Fisheries, Institute of Fresh Water Research Drottningholm. World Maritime University, Malmö.	34 603 000	**Abstract:** The aim of this program was to strengthen the technical capabilities of NARA and Ruhuna University and provide scientific data of relevance to environmental and natural resources management of the coastal areas. Biologists, chemists, physicists, economists and sociologists were working together to provide data on the environment and natural resources of the Puttalam Lagoon – Mundal Lake area in the North-West province of Sri Lanka. The research has been highly specialized in areas of fisheries biology, aquaculture, coral reef ecology, nutrient cycling and chemistry, physical oceanography, environmental fate of pesticides and socio-economy of coastal communities. An attempt has also been made to approach the question on how to resolve the multidisciplinary character of how to integrate scientific environmental data in coastal area management, and about the possibilities to use remote sensing and Geographical Information Systems.
1989–1994	Natural Resources & Environment	Rice Research	University of Peradiniya, Department of Agriculture.		6 100 000	**Abstract:** This collaborative program aimed at improving the capacity in Sri Lanka to deal with emerging new challenges in rice production. The program emphasized selection of new rice varieties less susceptible to certain diseases, less fertilizer demanding and better adopted to give sustained yields. The program involved training of Sri Lankan scientists at IRRI and upgrading of research laboratories in Sri Lanka.
1989–1992	Natural Resources & Environment	Food Policy Research	International Food Policy Research Institute/ARTI		2 400 000	**Abstract:** The main aim was to strengthen the research capacity at ARTI and to initiate research on the effects of a widening of the agrarian production. The institute is an important agrarian policy advisor and an improvement of the national food policy was necessary to reach self-sufficiency in food production. **Results:** The program was finished in 1992 due to cooperation problems between the two institutes.

Funding period	Area	Project	Counterpart in Sri Lanka	Counterpart in Sweden	Budget amount (SEK)	Abstract/Results
1994–2002	Natural Resources & Environment	Biochemical Pest Control	University of Peradeniya. Department of Chemistry	International Science Programs, Uppsala. Department of Plant and Forest Protection Sciences, SLU, Uppsala. Royal Institute of Technology (KTH) Stockholm, Department of Chemistry. Clinical Research Centre, Karolinska Institute.	14 800 000	**Abstract:** The overall aim of the project was the development of effective environmentally acceptable methods as alternatives to the presently used synthetic pesticides for the control of six-targets pests, including shot-hole borer of tea, tea termites and nematodes and vegetable pests. Sri Lanka's economy is to a large extent dependent on tea crops as tea is the country's largest export product. A major problem is how to protect the tea and other crops from pest attacks. Conventional methods of pest control involve the use of which has led to accumulation of toxic residues and development of resistance to pesticides. This project aims at developing strategies for environmentally acceptable methods of control of seven Sri Lankan pests. In the long and medium term, the project was to establish bioassay techniques to identify insecticidal and other bioactive extracts and compounds, train personnel in synthesis at MPhil and PhD levels. **Results:** 1994–1996 6 international publications and 10 national.
1994–1998	Basic Science & Technology	Renewable Energy and Energy Efficiency	Tea Research Institute (TRI), St Coombs, Talawakelle.	Royal Institute of Technology – KTH.	2 900 000	**Abstract:** The project was aimed at building research capacity in the field of renewable energy and energy efficiency with a particular case study of development of a combined solar-wood gasifier tea-drying process and studying efficiency of the electrical energy used in buildings. The use of solar energy is particular attractive as the number of sunshine hours in Sri Lanka per year exceed 4000.
1994–2007	Basic Science & Technology	Research Capacity Building in Electrical & Electronic Engineering	University of Peradeniya, Department of Electrical and Electronic Engineering.	Royal Institute of Technology – KTH. Department of Electric Power Engineering.	25 800 000	**Abstract:** Solid know-how in engineering sciences is fundamental for the industrial and economic development of Sri Lanka. The main aim of this program was to build research capacity through research training at the PhD, MPhil and MSc levels. This would enhance the capability of the teaching staff and to strengthen the existing postgraduate program in the areas where most of the training is presently carried out abroad, and thus reduce the brain-drain form the faculty. No significant research was carried out in this field in Sri Lanka by the time this project was started in 1994. The support has enabled the University of Peradiniya to establish links with KTH in different disciplines of electrical engineering.

Funding period	Area	Project	Counterpart in Sri Lanka	Counterpart in Sweden	Budget amount (SEK)	Abstract/Results
1994–1996	Research Infrastructure	Computerized Science and Technology Information	Natural Resources, Energy and Science Authority (NARESA), Colombo.		2 150 000	**Abstract:** This project aimed at strengthen NARESA to serve as a hub in supply of CD-ROM based information to the scientific and research community of Sri Lanka.
1998–2006	Research Infrastructure	IT and Internet Development	Lanka Educational Academic and Research Network (LEARN)		37 994 000	**Abstract:** The aim of this project was to provide Internet connectivity to all those institutions where Sida supported long-term research cooperation and to build technical and management capacity in information technology at technician, engineer and research levels. Campus wide networks were established at the universities of Peradeniya, Colombo, Ruhuna and NARA. Sida's support can be seen as assistance to introduce IT/Internet to Sri Lankan universities and is of great importance for Sri Lanka's possibilities to communicate with the international research community. During the continuation of the program in 2002, similar investments were planned to be made at the University of Jaffna, in the Northern Province. The University of Jaffna has struggled to continue research and training of students all through the years of the internal conflict.
1998–2007	Basic Science & Technology	Postgraduate Studies in IT	University of Colombo, School of Computing.	Stockholm University, Department of Computer and Systems Sciences.	27 000 000	**Abstract:** The aim of this project is to build management capacity in information technology at research level. Most computer science departments at Sri Lankan universities have few, or none, PhD-level staff members, and only a subset of these people are actively engaged in research. This program for split PhD-training intends to increase the number of university staff members capable of teaching advanced courses and organising computer science programs.
1998–2007	Social Sciences & Humanities	Regional Development in an Open Economy	University of Kelaniya, Department of Geography and Department of Economics.	Gothenburg University, Department of Human and Economic Geography.	18 600 000	**Abstract:** This project aims at building research capacity in the field of social sciences at Kelaniya University. It concerns regional development issues and will provide graduate and undergraduate students with field study experience. The project will conduct more focused studies on poverty alleviation, education and health improvements, fisheries developments, governance issues and entrepreneurial development. It is in collaboration with Gothenburg University and the intention is to develop long-term institutional means for ensuring the continuity of development studies. The project is supposed to help policy-making processes on regional development through ready availability of data and advice.

Funding period	Area	Project	Counterpart in Sri Lanka	Counterpart in Sweden	Budget amount (SEK)	Abstract/Results
1998–2007	Social Sciences & Humanities	Regional Imbalances and Poverty Alleviation	University of Jayewardenepura, Department of Geography.	Uppsala University, Department of Social and Economic Geography. Karlstad University, Department of Geography and Tourism.	18 009 000	**Abstract:** This project aims at building research capacity in the field of social sciences at the University of Sri Jayewardenepura. The project will carry out studies of poverty in Sri Lanka with special reference to the rural sector. The objectives are to assess the existing situation regarding poverty, analyse its culture and its relationship to development, food security, human health and nutrition. Other objectives are investigate feminisation of poverty assess past and present poverty alleviation strategies, analyse the role of political decision making, bureaucracy and NGOs in poverty alleviation, provide policy relevant recommendations leading to alternative approaches to the subject. The parallel project "Overcoming regional imbalances: approaches and strategies for the future" will analyse the economic, social, historical, political factors responsible for regional imbalances and critically assess the policy interventions undertaken to reduce regional inequalities.
1998–2007	Social Sciences & Humanities	University Staff Development	University of Colombo, Staff Development Centre. 12 universities are serviced.	Lund University.	9 250 000	**Abstract:** Main aim is to assist the national reforms being carried out regarding pedagogy at the universities of Sri Lanka. One major effort will be to "train the trainers" so all the Sri Lankan universities can be assisted in a more efficient way. The project was started to address the problem that a great part of the academic staff is not permanently employed and have great difficulties to advance there academic- and university responsibilities due to the limited possibilities to PhD studies in Social Sciences. **Results:** 2003: The project will motivate the academic staff in Sri Lanka to improve the pedagogy at the universities. 631 academic staff have been trained 1998–2002 this includes both junior and senior academic staff.
2000–2007	Basic Science & Technology	Thermostable depolymerase from thermostable microorganisms	Jaffna University	Lund University, Department of Biotechnology Chemical Centre	8 000 000	**Abstract:** The department of biochemistry is one among the very few departments in the University of Jaffna that does research and one of the few departments in the Universities of Sri Lanka, which does research on biotechnology. The strong demand for biotechnology knowledge based manpower in the country is expected to expand even more with the development towards a sustainable peace. The project consists of components of isolation, strain improvement of microorganisms, and their cultivation for the production of thermostable depolymerases by fermentation. A further component is the stream processing of the enzymes and protein engineering of the enzymes to increase their stability. In addition the gene cloning, mutagenesis and gene expression studies will further enrich the capacity building in basic sciences.

Funding period	Area	Project	Counterpart in Sri Lanka	Counterpart in Sweden	Budget amount (SEK)	Abstract/Results
2000–2002	Social Sciences & Humanities	Archeology	University of Kelaniya, Department of Archeology	Uppsala University, Department of Ancient History and Archeology. Stockholm University, Department of Quaternary Geology. Academy of Science, Stockholm.	3 000 000	**Abstract:** The project is aimed at finishing the research carried out by four PhD students within the field of archeology. They were part of a regional project which was terminated. The research concern archeology in southern Sri Lanka. The topics are urban origin of the southern Sri Lanka, development of the historical bronze technology in Sri Lanka, pleistocene climate in the uplands of Sri Lanka and archeology of the late pleistocene and early holocene pre-historic communities in the southern maritime area of Sri Lanka. The PhDs finished in 2002 and the project was stopped.
2003–2007	Social Sciences & Humanities	Social Reconstruction in the War-torn Areas of Sri Lanka	University of Peradeniya, Department of Sociology.	Gothenburg University, Department of Peace and Development Research (PADRIGU).	6 750 000	**Abstract:** The transition from war to peace is often a difficult and long-term process. The successes of any peace process will largely depend on the conditions for social reconstruction in terms of repatriation of refugees and internally displaced, resettlement and reintegration, income and employment opportunities, land rights, rights to explore natural resources and civil rights. This project aims at building research capacity in the field of social sciences at Peradeniya University by generating empirical knowledge and theoretical understanding about war-to-peace transitions from a point of view of social, cultural and economic development perspectives. The specific objectives of the research are to a) examine theoretical and methodological issues related to social reconstruction in war-to-peace transitions b) carry out research in the field c) generate policy-oriented information and procedures. The research will be carried out in three types of affected communities: the IDP camps, villages and relocated villages in the border districts in southern Sri Lanka.
2003–2007	Health	Health and Social Care for Socially Marginalized People	University of Sri Jayewardenepura, Department of Community Medicine and Family Medicine.	Uppsala University, International Maternal and Child Health.	6 850 000	**Abstract:** The project is a multidisciplinary attempt to carry out research on low-power groups of a society under a conflict situation. Emphasis will be on gender equity, violence against women and children, social issues related to Middle East migrant female workers, and issues of war widows and orphans. The project will furthermore study the planning and implementation of health care in conflict areas. Sri Lanka has a comparatively well-developed health care system. The system now faces new challenges when war-torn areas in the north and east will be incorporated in the national program for health care. Regions in the north and east have a vast population that is seriously affected by war and knowledge how to take care of this new situation is still under development.

Funding period	Area	Project	Counterpart in Sri Lanka	Counterpart in Sweden	Budget amount (SEK)	Abstract/Results
1987–2007	Research Infrastructure	Library Support	Seven Sri Lankan university libraries. The International Network for the Availability of Scientific Publications (INASP)		14 563 000	**Abstract:** Access to fresh international research results as they are presented in international scientific journals, databases and so on (in CD-ROM form or via direct access) is a prerequisite for meaningful research endeavor. The Sida Library Support Program has provided seven Sri Lankan university libraries with scientific journals. Recent activities has been in collaboration with the Britain based organisation International Network for the Availability of Scientific Publications (INASP).
1983–2007	Research Infrastructure	Scientific Infrastructure	Natural Resources, Energy & Science Authority (NARESA). National Science Foundation, Colombo.		17 309 000	**Abstract:** The scientific infrastructure support program was initiated in 1983 by providing funds for purchase of urgent spare parts and for maintaining international contacts. The support to international contacts has provided hundreds of Sri Lankan researchers the opportunity to attend important scientific events outside Sri Lanka and establish links with researchers abroad. A lot of laboratory equipment in Sri Lanka research institutions has been maintained in working order through purchase of urgent spares through this program. Sida has also provided funding for grant funds held at NSF (from 1983 to 1997 the funds were canalized through NARESA). Sri Lankan researchers and graduate students were able to apply for funding to pay for their research or to visit international conferences.
1986–1991	Research Infrastructure	Purchase of Mass Spectrometer Unit	Ceylon Institute for Scientific and Industrial Research (CISIR), Department of Chemistry, University of Peradiniya	University of Uppsala, International Seminar in Chemistry, Uppsala	2 100 000	**Abstract:** By 1984 there existed no mass spectrometer in Sri Lanka and analysis had to be done abroad which caused delays and/or destruction of prepared compounds. A mass spectrometer is mainly used for the identification of active substances in chemical compounds.
1989–2007	Other	Evaluations			2 380 000	**Abstract:** Some of the evaluations and financial audits performed in Sri Lanka, were financed within the bilateral budget.
2000–2002	Administration	Support to the University Grants Commission	University Grants Commission		400 000	**Abstract:** SAREC supported university projects were canalized through UGC during the period 2000–2002.
			Grand total	**SEK (current prices)**	**305 643 000**	

Annex 3 Sida/SAREC Funds Allocated to Vietnam, 1976–2006

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
Early projects							
1977–1979	Cooperation in the field of metrology	Vietnam National Metrology Centre, SCST, Hanoi: Dr. Ngo Huy Van		77–79	2 000 000		Funds were used to equip the Centre, which is the national reference centre for calibration and measurements.
				79	1 000 000	3 000 000	
1979–1983	Training program in rice research	Food Crops Research Institute, Ministry of Agriculture, Hai Hung: Dr. Vu Tuyen Hoang		79–81	290 000		Vietnamese researchers have been trained at IRRI and at the Central Rice Research Institute, Cuttack, India. A national seminar on rice research allowed participants to share information and identify priority areas for research.
				82/83	100 000		
				83/ 84	500 000	890 000	
Health							
1977–1991	Research on antibiotic resistance	National Institute of Hygiene and Epidemiology (NIHE), Ministry of Public Health, Hanoi: Prof. Dang Duc Trach	National Bacteriological Laboratory: Prof. Lars-Olof Kallings	77–79	555 000		The aim of the program was strengthening of research capability in the field of diarrhoeal diseases at NIHE by training of Vietnamese researchers in diagnostic procedures, lysotyping, determining of enterotoxins and production of sera and reagents. One student completed his PhD within the program and one article was published. In 1986 the project was subdivided into the Antibiotic resistance study and the Shigella vaccine study.
				79/80	550 000		
				80/81	500 000		
				82/83	500 000		
				83/84	500 000		
				84/85	350 000		
				85/86	400 000		
				86/87	600 000		
				87/88	580 000		
				88/89	200 000		
				90/91	103 000		
				91/92	50 000		
	Seminar on diarrhoeal diseases			87/88	50 000		Part of Antibiotic Resistans-project
				88/89	200 000	5 138 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
1985–1996	Research on Shigella vaccine	National Institute of Hygiene and Epidemiology: Prof. Dang Duc Trach	Dept.of Clinical Bacteriology, Karolinska Institute: Prof. Alf Lindeberg	84/85	400 000		Shigellosis (microbial dysentery) is one of the most serious causes of diarrhea in Vietnam. A vaccine has not been available against this infection. The project has resulted in the development of vaccine candidates which have been successfully tested in phase I trials in Sweden and Vietnam. Although no efficient vaccine was developed during the 10 years of cooperation, NIHE's capacity to utilise modern basic and applied biotechnology, especially in the field of vaccine development, has increased substantially. Two PhD and one MSc student have completed their training, and 15 publications were made.
				86/87	440 000		
				87/88	700 000		
				88/89	640 000		
				89/90	847 000		
				90/91	853 000		
				91/92	1 200 000		
				92/93	1 450 000		
				93/94	750 000		
				94/95	750 000		
				95/96	370 000	8 400 000	
1989–1996	Research on drug resistance of malaria	Institute of Malariology, Parasitology and Entomology, Ministry of Health, Hanoi: Prof. Vu Thi Phan	Dept.of Pharmaceut. Microbiology, Uppsala University: Prof. Ola Sköld	89/90	281 000		Malaria is a serious health problem in Vietnam, particularly since some malaria strains have developed resistance against available drugs. Within this project, the molecular biology of the parasite and the biochemistry and genetics of the drug resistance were explored, which has lead to the detection of resistant genes and new methodologies including the PCR technique.
				90/91	248 000		
				91/92	300 000		
				93/93	330 000		
				93/94	700 000		
				94/95	700 000		
				95/96	700 000	3 259 000	
1987	Project preparations			87/88	180 000		
				88/89	400 000		
1989–1996	Research on locally produced plant drugs (GECCCO project)	Uong Bi Hospital: Dr. Nguyen Ngoc Ham, Faculty of Chemistry, University of Hanoi: Dr. Nguyen Xuan Dung and Dr. Phan tong Son	Medical Products Agency, Uppsala: Prof. Nils Stjärnström Dept.of International Health Care Research (ICHAR), Karolinska Institute	89/90	499 000		Vietnam has a long tradition of using plants to treat diseases. However, the clinical value of traditional drugs is often questionable. The project has included training in the use of clinical trials for a number of Vietnamese scientists, physicians and nurses, and training of students in pharmacological analysis techniques. Clinical trials were conducted for drugs traditionally used for treatment of urine excretion, duodenal ulcers, burns and parasite infections and malaria. Although a clinical effect could only be established for an ointment for burns, both positive and negative trial results have generated new knowledge and an insight into the theory and practice of modern clinical trial methods. One person defended his licentiate thesis successfully within the program and 4 articles have been published.
				90/91	845 000		
				93/94	800 000		
				94/95	800 000		
				95/96	800 000	3 744 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
1991–2007	Health system research	Centre of Human Resources for Health (CHRH): Prof. Pham Huy Dung	Dept.of International Health Care Research (IHCAR), Karolinska Institute: Ass. Prof. Bengt Höijer, Prof. Vinod K. Diwan, Dr. Anna Thorson	91/92	350 000		Health System Research is intersectorial and interdisciplinary research aiming to optimize the national health care system and promote rational decision making about priority health problems at various levels. A field laboratory has been established as a base for a longitudinal epidemiological surveillance system in Vietnam and courses in basic epidemiology for research students are held there. 9 Vietnamese students have successfully defended their PhD dissertations and 15 students have finalized their MPH programs. 4 Post Docs. 65 articles have been published in international scientific journals. By 2000, 75 articles published in national scientific journals.
		Health Strategy and Policy Institute, Ministry of Health, Hanoi: PhD. Ng. Thi Kim Chuc		92/93	550 000		
				93/94	900 000		
				94/95	900 000		
				95/96	900 000		
				1997	2 000 000		
			Dept.of Public Health and Clinical Medicine, Umeå University	1998	2 000 000		
				1999	2 000 000		
		Hanoi Medical University: PhD Nguyen Thi Kim Chuc		2000	3 200 000		
				2001	3 200 000		
				2002	3 200 000		
				2004	4 000 000		
				2005	4 000 000		
				2006	4 000 000		
				2007	4 000 000	35 200 000	
1995	Gender perspective on health research in Vietnam	Hanoi Medical College	IHCAR, Karolinska Institute	95	150 000		
2000–2007	Study on treatment of common diseases in Vietnam	Hanoi Medical School: Prof. Nguyen Van Tuong	Karolinska Institute: Prof. Hans Rosling, Ass. Prof. Ingeborg van der Ploeg	2000	1 500 000		The aim of the program was to promote the application of modern advances in biotechnology and bio-medicines in rational diagnosis, control and treatment of prevalent disease in Vietnam. Areas of interest included pharmacology, microbiology and public health. 2004: Six PhD Vietnamese research students are involved in these projects, and another 8 student will complete their PhD within the program.
				2001	1 800 000		
				2002	2 700 000		
				2004	4 000 000		
				2005	4 000 000		
				2006	3 000 000		
				2007	3 000 000	20 000 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
Geo-technology							
	Sub-program coordination Vietnam			2004–2007	1 000 000		
1984–1986	Research on building climatology	Hanoi Architectural Institute, Ministry of Construction, Hanoi: Prof. Pham Van Trinh	Dept. of Building Sciences, University of Lund. Prof. Bo Adamsom	84/85	90 000		In this project researchers studied the influence of climactic factors dwellings in North Vietnam. The work followed several lines: architectural characteristics in traditional Vietnamese housing, indoor climatic conditions, thermal performance of buildings evaluated in computer simulations etc, and participants made recommendations for new types of housing.
				86/87	450 000	540 000	
1979–1987	Research cooperation in geotechnology	Institute of Building Science and Technology (IBST), Ministry of Construction, Hanoi: Dr. Nguyen Ba Ke	Swedish Geotechnical Institute (SGI): Dr. Bo Berggren	79/80	150 000		The project started in 1979 to transfer technology in the application of brand drains and columns for stabilisation of soft soils. It was soon extended to the application of modern piling and underpinning techniques. The cooperation gradually turned to research work and the research capacity of IBST in Hanoi was dramatically improved. In some cases the research went beyond the preliminary targets and could be considered as a new contribution to the geotechnical field. IBST is now one of the most advanced centres in this field in Southeast Asia. This cooperation led to the Research on building foundations project.
				80/81	500 000		
				82/83	600 000		
				83/84	550 000		
				84/85	390 000		
				85/86	350 000		
				86/87	200 000		
				87/88	60 000	2 800 000	
1987–1990	Research on reinforcement methods for building foundations		Swedish Geotechnical Institute (SGI): Dr. Bo Berggren	87/88	225 000		The methods developed in the geotechnology project were used to renovate about 50 buildings in Vietnam, reinforcing the building foundations. An International Geotechnical Conference was held in Hanoi in 1992 as a result of the 10 years cooperation of IBST and the Swedish Geotechnical Institute. 2 students completed their PhD and 40 international and national publications have been produced.
				88/89	300 000		
				89/90	390 000		
				91/92	170 000		
				92/93	400 000	1 485 000	
1993–96	Environmental research in the geotechnical field	Institute of Building Science and Technology, Ministry of Construction, Hanoi: Dr. Nguyen Truong Tien	Swedish Geotechnical Institute: Dr. Jan Hartlén	93/94	600 000		At the beginning of the program 10–12 million tones of coal ash had been dumped at open places throughout Vietnam. Besides being a general environmental problem, leaking of harmful elements from coal ash by rain water is a potential threat to contamination of ground water. The program aimed to develop knowledge in the environmental field and management of combustion residues. Results?
				94/95	400 000		
				95/96	580 000	1 580 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
Forestry research							
1986	Research on reforestation of vietnamese highlands	Research Centre for Forest Tree Improvement, Forestry Research Institute of Vietnam, Hanoi: Dr. Le Dinh Kha	Forest Research Institute of Sweden: Dr. Gunnar Jansson	86/87	200 000		The program started as a reforestation project of the 8 ha bare lands in Vietnam, which have been made vulnerable to erosion. The project has concentrated on selecting fast-growing tree species, provenance trials, setting up of seed orchards and on tissue culture technology and experiments with hybrids. In recent years emphasis was also put on capacity building and training of MSc and PhD students. Some research results were natural hybrid clones between two acacia species, which are fast growing and suitable for wood processing, as well as artificial hybrid combinations of eucalyptus species which are promising for planting in the flat and low hill areas of central Vietnam. 5 students have completed their PhD and another 5 students have reached an MSc degree. 17 articles have been published.
				87/88	180 000		
				88/89	300 000		
				89/90	145 000		
				90/91	145 000		
				91/92	275 000		
				92/93	260 000		
				93/94	500 000		
				94/95	550 000		
			Swedish University of Agricultural Sciences (SLU): Ass.Prof. Kenneth Lundkvist	95/96	550 000		
				1997	550 000		
				1998	550 000		
				1999	550 000		
				2000	1 200 000		
				2001	1 200 000		
				2002	1 300 000		
				2004	1 200 000		
				2005	1 200 000		
				2006	1 100 000		
				2007	1 000 000	12 955 000	
Agriculture							
1984	Project preparation	Research Centre for Experimental Biology, State Commission for Science and Technology, Ho Chi Minh City	Dept. of Plant fysiology, Lund University	84/85	60 000		Planning and development of a project concerning the production of concentrated leaf protein to be used as animal feed. The project was not continued.

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
1984	Research preparation	Can Tho University	Swedish University of Agricultural Sciences (SLU), National Food Administration (Livsmedelsverket)	84/85	200 000		Possibilities of cooperation between Can Tho University and SLU in the field of agriculture were explored. The preparations led to the later agricultural science collaborations, particularly the Livestock production program.
1986–1999	Research on utilization of acid soils	University of Cantho: Prof. Vo Tong Xuan	Departement of Soil Science, SLU: Prof. Invar Nilsson	86/87	200 000		Large forest areas in the Mekong Delta were devastated during the Vietnam War and are still denuded. The land has very low pH value, and unsuccessful attempts to recultivate the areas have resulted in the spreading of acid water to nearby fertile land. Research has concentrated on finding appropriate crops and suitable farming systems for this land with chemical techniques and mathematical models, in order to achieve environmentally sound farming system. In cooperation with the Mekong Secretariat the FAO soil classification system was introduced which defines the extent of each problem soil group on a soil map. The field work included 14 districts covering an area of 150000 ha. One PhD and three MSc students were trained (from 1993).
				87/88	350 000		
				88/89	400 000		
				89/90	977 000		
				90/91	999 000		
				91/92	860 000		
				92/93	750 000		
				93/94	800 000		
				94/95	600 000		
				95/96	700 000		
				1997	1 100 000		
				1998	820 000		
				1999	820 000	9 376 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
1989–2003	Livestock research and production/ Farming Systems R	Faculty of Animal Science and Veterinary Medicine, University of Agriculture and Forestry, Ho Chi Minh City: Prof. Luu Trong Hiue	Departement of Animal Nutrition and Management, Swedish University of Agricultural Sciences (SLU): Dr. Brian Ogle	89/90	823 000		The objective of the program was to build capacity to develop models on how to increase productivity and efficiency of livestock production using locally available feed from integrated, sustainable farming systems within the resources of small farms. The project has kept a holistic perspective on farming and production, and aimed to transfer new knowledge to the farmers. 21 Vietnamese Students have gained MSc degrees. 12 students have completed their PhD degrees. 100 articles have been published in national and international scientific journals. This project evolved into the Sustainable rural development program which started 2004.
				90/91	800 000		
				91/92	950 000		
				92/93	900 000		
		National Institute of Animal Husbandry, Ministry of Agriculture and Rural Development, Hanoi: Dr. Le Viet Ly		93/94	900 000		
				94/95	900 000		
				95/96	900 000		
				1997	1 200 000		
				1998	1 300 000		
				1999	1 500 000		
				1997	875 000		
				1998	825 000		
				1999	825 000		
		Can Tho University: Dr. Vo Van Son		2000	3 000 000		
				2001	2 500 000		
				2002	2 500 000	20 698 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
Earth metals							
1989	Research on rare earth minerals	National Research Centre: Prof. Nguyen Van Hieu	Dept.of process Metallurgy, Royal Technical Institute: Prof. Olle Wijk	89/90	626 000		Vietnam has large deposits of rare earth metals and research on rare earth metal oxides had been conducted at NRC for some years as the project began. The objective of the research cooperation was to develop methods by which Vietnam could produce pure metals and metal alloys using local raw material. The project has produced good results in terms of technical and scientific know-how and was recognized by MOST as a project of great economic importance for the country. 78 articles have been published and two students have completed their PhD.
				90/91	621 000		
				91/92	700 000		
				92/93	875 000		
				93/94	1 450 000		
				94/95	1 500 000		
				95/96	1 500 000		
				1997	1 450 000		
				1998	1 400 000		
				1999	1 150 000		
		IInstitute of Materials Science, National Centre for Natural Sciences and Technology, Hanoi: Dr. Dang Vu Minh	Dept.of Materials Science, Uppsala University: Dr. Lennart Hasselgren	2000	1 200 000		
				2001	800 000	13 272 000	
Bio-technology							
2000	Study on plant disease control	Agricultural Genetics Institute, Ministry of Agriculture and Rural Development, Hanoi: Dr. Le Thi Anh Hong	Department of Plant Pathology, Swedish University of Agricultural Sciences, Uppsala: Prof. Berndt Genhardson	2000	500 000		The aim of the study was to strengthen the biotechnological capacity of national plant pathology research in Vietnam. The project has been relevant to the crop improvements programs which have followed, such as the non-chemical control of coffee production.
				2001	700 000		
				2002	800 000	2 000 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
2004–2007	Non-chemical control of coffee production	Agricultural Genetics and Biotechnology Institute (AGBI), Ministry of Agriculture and Rural Development, Hanoi: Ass. Prof. Le Thi Anh Hong, PMPD		2004	800 000		Non-chemical control of coffee production is a prioritised area for research in Vietnam. Some of the research objectives are the improvement of research skills on genetic variability including tissue culture and somatic hybridisation, and the production and management of healthy seeds and plants in nursery systems. The project includes training of 2 PhD and 3 MSc students.
				2005	1 200 000		
				2006	800 000		
				2007	700 000	3 500 000	
2004–2007	Proteins for agricultural and medical use	Institute of Biotechnology (IBT), NCST, Hanoi: Dr. Troung Nam Hai	Uppsala University Centre for Surface Biotechnology: Dr. Andras Ballagi	2004	400 000		IBT is one of the largest and most advanced institutions in the region, and it is also competitive in an international context. As IBT needs to create collaboration links worldwide to improve quality of research, the collaboration was beneficial. Three sub-projects are of interest; the productions of amylases with improved activity, recombinant antigenic proteins for Salmonella for vaccine and diagnosis purposes, and neurotoxins from scorpions for medical use. The project included training of 2 PhD students, 2 MSc students and 3 technicians.
			Centre for Surface Biotechnology, Uppsala Biomedical Centre: Prof. Jan-Christer Janson	2005	850 000		
				2006	800 000		
				2007	750 000	2 800 000	
2004–2007	Training in agro-biotechnology	Nong Lam University, Ho Chi Minh City, Prof. Bui Cach Tuyen		2004	500 000		The Nong Lam University is one of the biggest agriculture universities in Vietnam, but it is in much need of improved research collaboration and further training of staff. Research areas of interest are plant biotechnology including bio safety, plant protection biotechnology and animal biotechnology. The program includes training of 20 MSc students and 5 PhD students.
				2005	800 000		
				2006	800 000		
				2007	400 000	2 500 000	
2004–2007	Probiotics for pig husbandry	Departement of Biotechnology-Microbiology, Hanoi University: Dr. Mai Thi Hang	Departement of Biotechnology, Lund University: Prof. Bo Mattiasson	2004	800 000		The project includes 2 PhD, 6 MSc and technician training with the purpose to build a knowledge base at the faculty of Agro-biology and strengthening the research capacity. The study involves the use of isolated microbes for producing desired hydrolytic enzymes and probiotics in animal feed, and develop user-friendly methods of producing enzyme and probiotic preparation for pig.
				2005	1 000 000		
				2006	700 000		
				2007	500 000	3 000 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
	Biotechnology Sub-program coordination	Stockholm Environment Institute (SEI)	MOST and other relevant institutions	2004–2007	1 800 000		It was proposed that Stockholm Environment Institute should receive funds to facilitates the Vietnamese-Swedish biotechnology cooperation, by coordinating the participation of Swedish research institutions and assisting the Vietnamese government and public sector institutions in their effort to develop bio safety assessment and management capacities. SEI were to provide information and analyses to Vietnamese institutions on policy issues in the arena of biotechnology and biosafety.
	Biotechnology Sub-program coordination, Vietnam			2004–2007	900 000		
Marine research							
1993–2005	Marine science program/ Coastal management	Nha Trang Institute of Oceanography (IO): Nguyen Tac An	International Centre for Livning Aquatic Resources Management, Manila, Philippines and Swedish Centre for Coastal Development and Management of Aquatic Resources (SWEDMAR), Gothenburg	93/94	600 000		This project addressed problems related to the over-use of marine resources and the degradations of the environmental quality of the coastal zone. The overall objective of the project has been to strengthen the technical capacity and capability of IO and HIO in developing a scientific basis for integrated coastal management in Vietnam. Modern technologies such as remote sensing, GIS, modeling and toxicity testing methods to study coastal ecosystems and processes have been applied. The goal was to develop databases for coastal environment and resources for integrated coastal management. 5–9 MSc and 5 PhD. 3 articles published nationally by 2000.
		Haipong Institute of Oceanology (HIO): Dr. Ng. Chu Hoi, Tran Dinh Lan		94/95	900 000		
				95/96	1 000 000		
				1997	1 500 000		
				1998	1 500 000		
				1999	1 400 000		
			Stockholm Environment Institute	2000	1 500 000		
				2001	1 500 000		
				2002	1 500 000		
			Departement of System Ecology, Stockholm University: Dr. Michael Tedengren	2004	1 500 000		
				2005	1 500 000	14 400 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
2004–2007	Evolution and management of coastal areas	Centre for Marine Environment Survey Research and Consultation, Institute of Mechanics, NCST, Hanoi: Prof. Pham Van Ninh	Departement of Water Resource Engineering, Lund University: Prof. Magnus Larson	2004	1 500 000		The coastal areas of Vietnam are subject to strong evolution due to erosion and accumulation processes. The goal of the program is an integrated and sustainable strategy for managing the coastal areas in Vietnam. Sustainable management depends on the ability to forecast and understand the evolutionary processes of the coastal areas at different scales. The socio-economic values of the coastal zones were also taken into consideration. Theoretical findings made in the Red River delta will be applied to other areas of Vietnam. 2 MSc students and 2 PhD students will be trained.
				2005	1 100 000		
				2006	850 000		
				2007	800 000	4 250 000	
Technology transfer							
	Research on technology transfer	Institute for Science Management (ISM), State Commission for Science and Technology, Hanoi: Dr. Vu Cao Dam	Research Policy Institute (RPI), University of Lund: Prof. Cleas Brunden-ius, Dr. Andrew Jamisom	84/85	210 000		Vietnam was going through a process of transition from centrally planned to market economy. In the context of this change, there was a need to restructure the scientific and technological capabilities to facilitate the transformation. This project investigated the process of institutional reform in the areas of scientific research and technological development. The research collaboration has resulted in a substantial increase in research capacity and international recognition of ISM. The project has led to a better understanding of the systematic constraints that affect the reform process and to the formulation of policy recommendations for new laws on foreign investment and on technology transfer in Vietnam. Three MSc students were trained and several discussion papers and reports were written, as well as one published article.
				85/86	250 000		
				86/87	300 000		
				87/88	150 000		
				88/89	100 000		
				89/90	180 000		
				90/91	125 000		
				91/92	315 000		
				92/93	300 000		
				93/94	550 000		
				94/95	550 000		
				95/96	550 000		
				1997	135 000		

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
1997–1999	Research on R&D policies	National Institute for Science and Technology Policy and Strategy Studies (NISTPASS), MOSTE		1997	730 000		This project was a follow up to the earlier R&D research, concentrating on necessary policy reforms in the transition process from centrally planned to market economy. One of the sub-projects was to strengthen the research capabilities of a group of researchers at NISTPASS, who would subsequently be able to assist organisations at the national or local levels in designing and implementing effective priority setting activities. One book was written in the subject, two students completed their PhD and one student reached an MSc.
				1998	730 000		
				1999	730 000		
2000–2002	Technological capabilities and competitiveness	NISTPASS, MOSTE: Dr. Nguyen Ngoc Tien	Research Policy Institute, University of Lund: Prof. Jon Sigurdson	2000	900 000		As a continuation of earlier S&T policy research, the objective of this project was to examine the partnership between R&D institutions, enterprises and government in strengthening the national technological innovation capabilities to improve national development in the context of economic liberalization and globalization. The project focused on a scientific and practical base for selecting new policies, helping the S&T system to become a core element for technological innovation in production.
				2001	800 000		
				2002	800 000	2 500 000	
2004–2007	Technology transfer to agricultural SMEs	NISTPASS: PhD Tran Ngoc Ca	Department of Technology and Social Change, Linköping University: Prof. Charles Edquist	2004	500 000		The project investigated factors influencing market institutions to promoting technological transfers to agriculture-based small and medium enterprises (SME). The main objective was to examine the technology market institutions, universities and activities of other actors, such as foreign technology carriers, in strengthening the competitiveness of the agro-industry.
				2005	700 000		
				2006	700 000		
				2007	400 000	2 300 000	
Humanities and Social Sciences							
1984–1996	Research program on women	Research Centre on Women, State Commission for Social Sciences, Hanoi: Prof. Le Thi	Departement of Sociology, Göteborg University: Prof. Rita Liljeström	84/85	150 000		The project started with a very broad program for research on women: working conditions for women in industry and agriculture, child care, the position of women in the educational sector, and maternal and child health care. Since 1989 the research has concentrated on female-headed families and on family and kinship systems.
				85/86	300 000		
				86/87	Funds from previous year		
				87/88	100 000		
				88/89	100 000		
				89/90	508 000		
				90/91	448 000		
				91/92	470 000		
				92/93	600 000		
				93–96	Utilizing remaining funds	2 676 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
1989–1991	Documentation of modern history	Departement of History, University of Can Tho	Departement of Social Anthro-pology, Lund University: Prof. Kajsa Ekholm -Friedman	89/90	85 000		This was a feasibility study to determine the possibility of establishing an archive to document the oral tradition in Vietnam. The project was not continued.
				90/91	150 000	235 000	
1991–96	Issues in economic developement /Macroeconomy	Istitute for Long-term and Regional Planning (ILRP)	Stockholm School of Economics	91/92	700 000		Due to the rapid transformation of the Vietnamese economy research collaboration was initiated with the Stockholm School of economics. Areas like the effects of foreign direct investments in Vietnam and the financial markets and institutions in the country were studied. The project involved training of researches both from ILRP and students from NEU. A large part of the funds concentrated on MSc and PhD training of students at NEU, particularly during the last phase of the project.
				92/93	775 000		
				93/94	600 000		
				94/95	600 000		
				95/96	600 000		
	Research support	National Economic University	Stockholm School of Economics	1997	250 000		
				1998	600 000		
				1999	600 000	4 725 000	
1997	Study of research system	MOSTE		1997	600 000		The aim of the project was to create an overview and analyze the financing of the research system in Vietnam.
2000–2002	Preparation for research program in social sciences	National Centre for Social Sciences and Humanities (NCSSH): Prof. Nam	Centre of Pacific Asian Studies, Stockholm University: Prof. Torbjörn Lodén	2000	1 000 000		In times of globalisation no nation can solve its problems connected with development in isolation. Very few studies have been related to these changes and there is a need for new methodologies and ideas for science in this field. A planning grant was given to NCSSH to arrange a workshop in November 1999, in order to identify priority areas for research cooperation. The later social science projects were developed during these preparations.
				2001	2 000 000		
				2002	2 000 000		
2004–2007	Sustainable rural development	Hue University of Agriculture and Forestry (UAF): PhD Le Duc Ngoan	Departement of Rural Develop-ment Studies (DRDS), SLU: PhD Britta Antonsson-Ogle	2004	3 500 000		This research and capacity building program combines approaches in social and natural sciences, system analysis, natural resources manage-ment and rural livelihood analysis. The main objective is to further develop existing research and teaching capacity at the institutions in Vietnam, to enable them to carry out multidisciplinary research designed to promote development and reduce poverty in rural areas. 3 PhD students and 20 MSc students will be trained.
				2005	4 000 000		
				2006	3 500 000		
				2007	3 000 000	14 000 000	
2004-2007	Rural poor in export-led growth	NCSSH: PhD Nguyen Thi Thanh Ha	Centre of Environmental Studies (MICLU), Lund University: PhD Anne Jerneck	2004	1 000 000		The program aims to gather knowledge in the specific research area by carrying out empirical investigations into the core issue of rising income inequality in Vietnam. The finding will be relevant for major stakeholders and targeted beneficiaries including policy makers, business workers and migrants from rural areas.
				2005	1 200 000		
				2006	1 000 000		
				2007	1 000 000	4 200 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
2004–2007	Rural families in transitional Vietnam	NSSCH: PhD Trinh Duy Luan	Centre for Asian Studies, Göteborg University: PhD Will Burghoorn	2004	700 000		The overall objective is to analyse the complex situation and dynamics of rural Vietnamese families in a rapidly changing society. By an interdisciplinary approach and comparative research focusing on variables such as production, ethnicity, gender, age and migration, the study will enhance the knowledge about Vietnamese society.
				2005	1 000 000		
				2006	900 000		
				2007	700 000	3 300 000	
	Sub-program coordination, Sweden			2004–2007	1 000 000	1 000 000	
	Sub-program coordination, Vietnam			2004–2007	950 000	950 000	
Infrastructure							
Library support							
1986–2002	Library support program (LSP)	Central Library for Science and Technology (CLST): Mr Vu Van Son		86/87	250 000		The LSP aimed to help build up national research capacity in the country. Libraries are perceived as part of the research infrastructure, enabling researchers to obtain essential information in their fields through the access to collections of books, periodicals and electronic information. The funds were used for purchase of books and periodicals as well as for training of library staff.
				87/88	375 000		
				88/89	510 000		
		University Library at Can Tho University (CTUL)		89/90	400 000		
				90/91	400 000		
				91/92	450 000		
				92/93	450 000		
				93/94	450 000		
				94/95	450 000		
				95/96	450 000		
		MOSTE		1997	1 000 000		
				1998	1 000 000		
				1999	1 000 000		
				2000	800 000		
				2001	700 000		
				2002	500 000	9 185 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
Open Fund							
1979–2003		State Commission for Science and Technology (SCST)		79/80	690 000		This fund provided budgetary support used for various ad hoc purposes, e.g. participation in seminars and training courses, purchase of equipment and literature, hiring of consultants and project preparations.
				80/81	670 000		
				82/83	600 000		
				83/84	650 000		
				84/85	550 000		
				85/86	Balance from previous agreements: 1 500 000		
				86/87	660 000		
		MOSTE		92/93	540 000		
				93/94	400 000		
				94/95	400 000		
				95/96	400 000		
				1997	1 135 000		
				1998	1 120 000		
				1999	1 120 000		
				2000	2 000 000		
				2001	2 000 000		
				2002	2 000 000	16 497 000	
Other							
1997–1999	Project preparations			1997	500 000		
				1999	600 000		
	Evaluations			1998	600 000		
	Extras			1997	470 000		
				1998	455 000		
				1999	405 000	3 030 000	

Funding period	Project	Counterpart in Vietnam	Counterpart in Sweden	Year	Budget amount (SEK)	Budget summary (SEK)	Abstract/Results
1997	Research support	Faculty of Health, Hanoi University		1997	600 000		Council On Health Research for Development (COHRED) planned to examine the most important research areas in Vietnam (Essential National Health Research, ENHR).
				1998	1 000 000		
				1999	1 500 000	3 100 000	
2000	Internet training	National Steering Committe for International Utilization	SAREC	2000	1 000 000		
				2001	1 000 000		
				2002	1 000 000	3 000 000	
2004–2007	Coordination-project	MOST		2004	2 000 000		From 2004 MOST took responsibility for the overall management of the programs and was made accountable to Sida and the Vietnamese Government on the utilisation of funds received. In order to ensure the role of MOST in coordinating the programs, there was a need to strengthen the management capacity at MOST. Hence a Program Management Unit (PMU) was formed and supported by the coordination-project, through training of staff within research administration and quality assurance in research, as well as development of channels of communication with R&D stakeholders and policy makers.
				2005	2 000 000		
				2006	1 500 000		
				2007	1 500 000	7 000 000	
2004–2007	Research fund	MOST; PMU		2004	5 000 000		A research fund has been developed, to which qualified researchers are encouraged to send their research applications for assessment. The fund was open in the sense that researchers from whole of Vietnam could apply. The research fund has accepted 40 project applications so far from various scientific fields.
				2005	5 000 000		
						10 000 000	

Annex 4 Terms of Reference

1. Purpose and Scope of the Study

The purpose of the study is to assess the impact, at different levels of Swedish bilateral research support to Sri Lanka and Vietnam during the period from 1976 to 2006. The study should be done against the background of the development of the research systems in these countries and to assess to which extent the Swedish support to research, through its various phases has been in line with the national efforts and contributed to strengthening of the national research systems.

The study will be used as a contribution to the ongoing learning process at Sida on how to strengthen systems for national research capacity and use research and development to accelerate social and economic progress.

2. Background

Swedish support to bilateral research cooperation with Sri Lanka and Vietnam, respectively was initiated in 1976. The support was administrated by the then recently established Swedish Agency for Research Cooperation with Developing Countries, SAREC. The first 10 years of SAREC support are characterized by support to national research councils. In Sri Lanka the National Science Council and Agrarian Research and Training Institute was chosen as the main recipients of the support and in Vietnam the support was directed to the State Commission for Science and Technology (SCST).

In both countries it became evident that these bodies lacked the capability to prioritize research based on scientific criteria. A countermeasure during the next period was to strengthen research capacity through research training using the so-called "sandwich model", which is still in use. Over time, it became obvious that training of researchers had to be supplemented with investments in research infrastructures and scientific equipment. Catering for the needs of scientific information support to libraries and archives was included in the approach. Together, these should contribute to the establishment of research environments that would be attractive work places for the researchers trained in the bilateral programmes. During this period the characteristic of the bilateral support from Sida/SAREC as by being long-term in approach and to address the institutional rather than the individual level, took shape. In both countries dialouge with national structures has guided the orientation of the support.

After thirty years of research cooperation with Sri Lanka and Vietnam Sida/SAREC has decided to gradually phase out the research support to these countries. This long time of research collaboration has generated some two hundred PhDs in the two countries and numerous of research publications. The main purpose of this study is however not to evaluate the output of all the different projects and programmes but to get an overview of the outcome and impact of some major projects and the development of the national research systems in both countries during the period from 1976 – 2006 and to summarize the main lessons learned.

3. Tasks and Questions

In the countries

General issues

The study shall include a brief overview (5–10 pages for each country) of the development of the research systems in Sri Lanka and Vietnam, respectively during the period 1976–2006. The following issues should be addressed:

– the main actors in the national research systems;

– the main mechanisms for steering of the national research systems;

– the mechanisms for development of strategic plans and policies for research and development;

– the main impediments for support to the research funding systems;

– the formal or informal channels for interaction with the system and for utilization of research results by different sectors, such as the health sector, the agricultural sector, the industry etc.;

Specific issues

The long-term impact of the Sida/SAREC support at different levels shall be assessed by case studies at selected research organisations. The assessment can be done in several ways and the following is a non-exhaustive list of indicators. Data should be presented in a gender disaggregated manner, when applicable.

1. Sri Lanka

– Assess the impact of the support from Sida/SAREC to two of the major programmes *(i.e.* Biotechnology programme, University of Colombo and Electrical engineering, University of Peradeniya) in terms of research capacity at both individual and institutional level, capacity to secure funds from other sources, capacity to manage research funds;

– Assess the impact of the support from Sida/SAREC on the quality of the education of the students at the two above-mentioned departments;

– Assess if research findings have found useful applications in the countries;

– Assess the impact of the support from Sida/SAREC to the Swedish partners *(i.e.* Biotechnology programme, Uppsala University and Electrical Engineering, Royal Institute of Technology, Stockholm) in terms of research capacity, internationalisation of research and on competence in research of relevance for developing countries;

– Compile information on the careers of students trained in the two above-mentioned programmes;

– Assess the efficiency of the "sandwich model" for research training used in the two above-mentioned programmes compared to national research training and other scholarship programmes;

– Visit relevant ministries and institutions such as National Science Foundation to discuss their perception of the impact of the support from Sida/SAREC.

– Discuss the composition of the port-folio against the background of the research needs and priorities of Sri Lanka, as identified from national research policies and strategies during the period concerned and its contribution to poverty reduction, as well as gender aspects.

2. Vietnam

– Assess the impact of the support from Sida/SAREC to two of the major programmes *(i.e.* Health programme, Hanoi Medical University and Rural Development programme mainly through Hue University for Agriculture and Forestry) in terms of research capacity at both individual and institutional level, capacity to secure funds from other sources, capacity to manage research funds;

– Assess the impact of the support from Sida/SAREC on the quality of the education of the students at the two above-mentioned universities;

– Assess if research findings have found useful applications in the countries;

– Assess the impact of the support from Sida/SAREC to the Swedish partners *(i.e.* Health programme – Health systems research and Common diseases, Karolinska Institutet, Stockholm and Rural development programme, SLU, Uppsala) in terms of research capacity, internationalisation of research and on competence in research of relevance for developing countries;

– Compile information on the careers of students trained in the two above-mentioned programmes;

– Assess the efficiency of the "sandwich model" for research training used in the two above-mentioned programmes compared to national research training and other scholarship programmes;

– Visit relevant ministries and institutions such as MOST, MPI to discuss their perception of the impact of the support from Sida/SAREC.

– Discuss the composition of the port-folio against the background of the research needs and priorities of Vietnam, as identified from national research policies and strategies during the period concerned and its contribution to poverty reduction, as well as gender aspects.

3. Sri Lanka and Vietnam

– Compare similarities and differences between the two countries as concerns the national research policies and strategies and the research support from Sida.

At Sida/SAREC

– Give a brief overview of the procedure for preparation of the support at Sida/SAREC, with emphasis on how the documentation presented to the decision-taking body at SAREC and later Sida has evolved from 1976 to 2003 in relation to the aim of the support during different phases;

– Comment on the procedure for selection of collaborating institutions (both in Sweden and the countries);

– Compile information on support to different projects and programmes during the period 1976–2006 for both countries (e.g. project title, collaborating institutions etc.) to be presented as an annex to the report.

4. Recommendations and Lessons

– What are the lessons learned and recommendations that can be given to the research communities and authorities in the two countries as for the future development of their research capability and national research system?

– Which structure in the countries would be the most suitable to manage a future programme for facilitation of research contacts between Sweden and the countries?

5. Team, Methodology and Time Schedule

The study should be a joint effort of two experts, with competence in research policy and good knowledge of the research systems in Sri Lanka and Vietnam. The team should use the documentation available at Sida and at the collaborating research organisations in Sri Lanka, Vietnam and Sweden.

The mission shall start by a visit to Sida at mid-January, 2007. During the stay in Sweden visits shall be made to three Swedish research departments that have been involved in major research programmes in either Sri Lanka or Vietnam. Interviews should be made also with former Sida/SAREC staff in charge of the support to the countries.

Visits to Vietnam (before the Tet-celebrations) and to Sri Lanka shall be made before the end of February 2007.

In both countries the team is expected to interview programme coordinators, representatives at responsible ministries (in Vietnam: Ministry of Science and Technology, and Ministry of Planning and Investment and some line ministries) and staff at the Swedish Embassies.

6. Reporting

The report shall be written in English and shall not exceed 60 pages, excluding annexes. Format and outline of the report shall be mainly in line with the guidelines enclosed to this Terms of Reference.

A draft report should be submitted to Sida/SAREC no later than April 10, 2007. Comments by Sida/SAREC will be provided within two weeks of receipt of the draft report. The final report shall be submitted no later than May 10, 2007. Subject to Sida's decision, the report may be published and distributed within the Sida Evaluation series.

Recent Sida Evaluations

2008:03 Phasing-out Swedish Health Support in Luanda, Angola
A study of the Evolution of Reproductive and Child Health Services, 2006–2007
Kajsa Pehrsson, Kenneth Challis, Tazi Maghema
Department for Democracy and Social Development

2008:04 The Southeast Asian Network for Agroforestry Education (SEANAFE), Phase II
Indonesia, Laos, Philippines, Thailand, Vietnam
"Sharing Knowledge on Markets, Landscapes, and Environmental Policies"
Bo Tengnäs, Awang Noor Abd. Ghani, Hendra Yanto
Department for Natural Resources and Environment

2008:05 Apoio Saudável? Um Estudo do Apoio Sueco à Saúde em Angola 1977–2006
Kajsa Pehrsson, Lillemor Andersson-Brolin, Staffan Salmonsson
Department for Democracy and Social Development

2008:06 Organisation for Social Science Research in Eastern and Southern Africa (OSSREA)
David J. Francis, Jim Björkman, James Manor
Department for Research Cooperation

2008:07 Sida's support to Information and Communications Technologies (ICT) for development
Alan Greenberg
Department for Infrastructure and Economic Cooperation

2008:08 Capacity Building for Decentralisation and Local Self-Governance, phase II, Mongolia, 2001–2004
Staffan Engblom, Nicklas Svensson, Peter Westermark
Department for Infrastructure and Economic Cooperation

2008:09 African Universities Responding to HIV/AIDS
Daniel K. B. Inkoom
Department for Africa

2008:10 Sida Funded Initiatives Targeted at Gender Equality in Georgia
Gabriella Byron, Ruth Jacobson, Nino Saakashvili
Department for Europe

2008:11 External Analysis of Forum Syd's Country Prorams in Central America
Pierre Frühling, Francesca Jessup
Department for Latin America

2008:12 Financial Management Cooperation Project in the Eastern Cape Provincial Administration through Support from the Swedish National Financial Management Authority (ESV)
Chris Albertyn
Department for Africa

2008:13 Policy Guidance and Results Management of Sida's Education Support
Henny Andersen, Steve Packer, Michael Ratcliffe
Department for Evaluation in collaboration with Department for Democracy and Social Development

Sida Evaluations may be ordered from:

Infocenter, Sida
SE-105 25 Stockholm
Phone: +46 (0)8 779 96 50
Fax: +46 (0)8 779 96 10
sida@sida.se

A complete backlist of earlier evaluation reports may be ordered from:

Sida, UTV, SE-105 25 Stockholm
Phone: +46 (0) 8 698 51 63
Fax: +46 (0) 8 698 56 43
Homepage: http://www.sida.se

SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
SE-105 25 Stockholm, Sweden
Tel: +46 (0)8-698 50 00. Fax: +46 (0)8-20 88 64
E-mail: sida@sida.se. Homepage: http://www.sida.se