2012:5 Sida Evaluation

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Evaluation of Sida's Support to Innovation Systems and Clusters, a Research Cooperation Initiative

Main report

Sida

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Submitted by Policy research international inc to the Management Group

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Jointly commissioned by Sida's Unit for Monitoring and Evaluation and the Unit for Research Cooperation.

Published by: Sida, 2012

Date of final report: October 2011

Printed by: Citat/Edita 2012

Art.no.: SIDA61538en

urn:nbn:se:sida-61538en

ISBN 978-91-586-4208-9

ISSN 1401-0402

This publication can be downloaded/ordered from www.Sida.se/publications

Foreword

In recent years there has been increased attention to knowledge formation and innovation systems in economic development processes among high and low-income countries alike. A greater recognition of the role of knowledge carries with it a focus on the importance of research, and a potentially more central role for universities and other institutes of higher education and learning. The current strategy for Sida's research cooperation does, in a similar manner, point to investments in innovation systems as a means to encourage opportunities for utilizing research as a tool for development.

This evaluation report covers the period from 1997 to 2011, and provides a critical overview of 10 programs within Sida's support to strengthen research in innovation systems in low-income countries. It was commissioned by Sida's Unit for Research Cooperation in order to draw lessons from the results of the programs which aim to make use of research results produced. The lessons learnt described in the report aim to provide Sida with a recommendations to work in a more strategic manner with research and innovation systems. The report was carried out by an independent evaluation team, and it is presented in two volumes: A Main Report and a Collection of Individual Cases, that focus on the portfolio and program levels respectively.

It is not an easy task to evaluate a portfolio as heterogeneous as the one examined here, where programs vary in size as well as in life span. In addition, many of the concepts used here are inherently difficult to measure, and to isolate the effects of particular factors (such as Swedish Aid) on outcomes is challenging, to say the least. As the evaluation is strategic in nature, the programs were grouped into a handful of 'ways of working' for Sida and the focus was put on assessing them as such, primarily at the portfolio level and with a future-looking perspective in mind. Yet sound evaluation practices have been applied to all of the cases analyzed, lending credibility to the results as a whole. The analysis in the report is based on desk study reviews of key documents, earlier assessments, meetings with key informants and visits by the consultants to all countries represented, as well as an electronic survey submitted to those programs where this was deemed the most appropriate method.

The evaluators identify largely positive results for the cluster initiatives in Uganda, Tanzania, Mozambique, and Bolivia, in particular in relation to the costs of the programs. Relevant, cost efficient, and quality improving knowledge has been transferred in the links between universities, local authorities, and local organizations (business and civil society) that have been formed within the initiatives. This has resulted in increased trust among actors, as well as innovations that increase outputs, efficiency, jobs, incomes, and productivity of participating small firms. The program in Nicaragua addressed one element of the innovation system – the universities – and has been successful in increasing their internal capacity to contribute to innovation related activities, something otherwise found to be a bottleneck across the portfolio. Two consecutive regional programs on Bio-technology in Africa illustrate the challenges faced when seeking to add innovation to a 'traditional' research capacity building program, within a field of knowledge, which is sometimes new, to the countries involved. Three networks of researchers and policy makers complement the other programs in the portfolio, and constitute a source of knowledge on innovation, the role of universities as catalyst for development, which Sida ought to utilize further.

It is worth highlighting a few success factors of the programs. The evaluators find that the slow speed by which the cluster programs were allowed to evolve – some three years between involvement of core groups and individuals (through dialogue and conference participations), and the start of the pilot programs – has helped ensure local ownership. They conclude that, having at least a dozen people who are trained, who have access to capacity and resources, and are motivated and inspired to work together, constitute among the key factors needed to catalyze the innovation process. Moreover, the systematic approach and cooperation between Sida and its partners, based on smaller pilots and exploratory grants, combined with increased funding from Sida's Global and Regional programs when results appeared promising, allowed for a slow merger of the programs into larger bilateral country funding frames when appropriate.

At a more general level, the evaluators conclude that the theoretical frameworks and ideas applied within innovation systems and cluster initiatives have provided Sida with useful conceptual tools. These have enabled the agency to combine its role in promoting capacity development in research and knowledge creation, with its role in supporting the underlying premises of Swedish development assistance

– namely, to improve conditions for sustainable economic growth processes in low income countries. The evaluators point out that similar ideas and practices are used in other areas of Swedish development assistance, for example in support to health and agriculture programs. Less attention is usually paid to the higher education sector and the possibilities offered there. They suggest that Sida should expand the usage of innovation system frameworks and cluster modalities not only to other bilateral partner countries within its research cooperation, but also further across the organization to other relevant areas, and that this could be done with relative ease.

This is relevant from the perspective of the findings (in the evaluation as well as elsewhere) that, *the bulk* of innovations that occur in developing countries are not always directly based on new scientific research and is mostly 'local' in nature. For example, new uses of mobile telephones, the development of new seeds and low cost generic drugs for HIV/AIDS are the exception rather than the rule of how local research efforts, complemented with international links may result in high impact, first-in-the-world innovations. Innovation occurs in all segments of society, it involves interaction between actors from various sectors, and it requires a degree of trust as well as different kinds of learning. It is, however, also true that there is a gap between the basic knowledge found within the education systems, and that which is available to entrepreneurs and small producers. The evaluators find the economic value of the direct use of a minor subset of this knowledge, by the small firms and micro entrepreneurs involved in the programs evaluated, to be striking.

It is our hope that this evaluation report, with its two volumes, will contribute to providing a strategic and concrete roadmap for Sida to continue to support innovation programs within scientific research cooperation. It is also our hope that the results from the report can provide a platform for Sida to consider to work in support of Innovation systems and practices in other relevant areas of international development cooperation. Finally, it is our hope that the results from this report inspire other donor agencies, academic institutions, governmental institutions, as well as the private sector, to consider the possibilities that stem from research and extend to innovation systems and the potential for sustainable inclusive economic development in developing countries. As the use and implementation of research results and innovative new practices often require a change of mind sets, funding agencies perhaps need to consider a change in terms of the current "risk appetite" for supporting

programs that include new processes, new technologies, new ways of working that might not be in line with the conventional ways of the past. Thus we need to take a progressive step into the use and support of new concepts, and the use of systems and models that use solid scientific research results, as well as local knowledge for innovating practices.

The views in the report are those of the independent evaluators, and not those of Sida.

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Abbreviations

ADB	Asian Development Bank
B4D	Business for Development, a Sida program
BIO-EARN	East African Regional Programme and Research Network for Bio-technology
Bio-Innovate	Bio-resources Innovations Network
CI	Cluster Initiatives
CG	Consultation Group
CNU	Consejo Nacional de Universidades
DFID	Department for International Development, United Kingdom
FORSK	Sida's Unit for Research Cooperation
IDRC	International Development Research Centre
IFORD	International Forum of Research Donors
IP	Intellectual Property
IS	Innovation System
IUP	Innovative University Program
ISCP-EA	Innovation Systems and Clusters Program for Eastern Africa
M&E	Monitoring and Evaluation
MG	Management Group
NIS	National Innovation Systems
NUR	National University of Rwanda
OECD	Organisation for Economic Co-operation and Development
PACF	Pan African Competitiveness Forum
PRI	Policy Research International
RBM	Results-Based Management
RG	Reference Group

SAREC	Sida's Department for Research Cooperation (name used until 2008)
SDC	Swiss Development Cooperation
SEI	Stockholm Environmental Institute
SEK	Swedish Krona
SICD	Scandinavian Institute for Competitiveness and Development
Sida	Swedish International Development Cooperation Agency
TCI	The Competitiveness Institute
ToR	Terms of Reference
VINNOVA	Swedish Governmental Agency for Innovation Systems

Executive summary

This report responds to Sida's request for a strategic evaluation of its portfolio of innovation-related contributions to research cooperation. This request emerged in an environment of growing:

- Attention to innovation systems and clusters and their role in developing and low-income countries;
- Recognition of the importance of innovation to economic growth and poverty reduction;
- Attention to the role of research and knowledge; and
- Interest in the more central role universities could play in this context.

One of the objectives stated in the most recent strategy (2010–2014) for Sida's support to research cooperation is to encourage "opportunities for utilizing research as a tool of development" and to ensure that those opportunities are "enhanced by such means as investment in innovation systems."

The main purpose of this evaluation is to provide Sida with strategic "knowledge and lessons learned" based on the experiences and emerging results from their portfolio of support to innovation systems and clusters within their research cooperation unit. As Sida has noted, applications of innovation-related concepts and models in developing and low-income countries take place under conditions very different from those in high-income countries. The evaluation focuses on the assessment of this portfolio as a collection of "ways of working" for Sida in these challenging contexts, rather than on the evaluation of the results of each project contribution per se. The evaluation should also be of interest to donor agencies seeking to learn more about how to work with and address issues of innovation systems and cluster development and to developing country partners and stakeholders seeking to make better use of knowledge inputs for growth and poverty reduction.

The report is presented in six chapters: Chapter 1 describes the purpose and universe of the evaluation; Chapter 2 describes the Sida portfolio, the study methodology, work plan and timeline, and other operational details; Chapter 3 contains a short overview of the

Swedish policy context, highlighting the priority it places on growth and innovation in poor countries, and an overview of the relevant theory that was requested by Sida; Chapter 4 discusses the main findings; Chapter 5 presents the main conclusions; and, Chapter 6 sets forth recommendations. Three annexes provide a list of references to the documents cited in the main report, the complete Terms of Reference, and the biographic information on team members.

There is a separate report on the individual cases in the portfolio, which contains more detailed information on each individual case in the portfolio studied. Each intervention in the portfolio is covered as a case study in the second volume, starting with project history and moving on to developments, findings, outputs, outcomes, conclusions and recommendations. The case studies include results from the surveys done with project stakeholders. These details are provided to make the overall findings transparent, and to give easy access to the specific material that is most relevant to specific stakeholders and provide a solid empirical base for this (main) report. The names of all persons interviewed are listed in the second volume containing the cases.

THE PORTFOLIO

The evaluation covers a portfolio of 10 distinct programs (some with sub-programs) that received support from the Unit for Research Cooperation. A schematic sketch of the universe is shown in Figure 1 (Chapter 1 – Introduction). The 10 interventions also had some linkages between them. The interventions can be grouped into four major ways of working for Sida, each representing an approach to working with the use of research-based knowledge and the ideas of innovation systems, namely:

1. Uganda, Tanzania, Mozambique, Bolivia and one network (PACF) experiment with the "Triple Helix" methods for the development of innovations in clusters.
2. Nicaragua experiments with a "stakeholder approach" to help universities and their coordinating bodies to engage in partnerships with other key stakeholders to promote innovation.
3. Two projects in biotechnology (BIO-EARN, Bio-Innovate) experiment with extending traditional research support (i.e. sandwich training and capacity building) to new fields of science, so that the enhanced capacity can provide the base for an innovations platform.

4. Two policy research networks explore the role of universities in the innovation processes (UNIDEV) and the role of innovation in development processes and policy (Globelics).

The first four national projects aimed to promote the economic performance of firms through the use of the knowledge and research capacities of universities via cluster initiatives. The fifth intervention in Nicaragua operated on the same premise, but aimed first to increase the organizational capacity of the knowledge production entity. All five national projects aimed to increase outputs of relevant research, transfer knowledge effectively to users, and encourage innovation in firms. They can be compared in terms of improvements in the application of knowledge and improvements in economic outputs through changes in stakeholder capacity.

The BIO-EARN project started with training and increasing the capacity of individual researchers for Ph.D. degrees within a well-established "sandwich" model. In this model, improved capacity, combined with new facilities and a network, lead to increased research on relevant biotechnologies and new knowledge. The dissemination of this knowledge and the involvement of policy makers lead to policy changes. All of these developments together lead to either new technologies further applied to solve problems or final innovation in new products or processes that lead to positive growth effects (the classic "linear" model of research to use).

The three networks in the portfolio – PACF, UNIDEV and Globelics – catered to a different set of issues. They were primarily designed to facilitate knowledge exchange among a much larger number of people, outputs and outcomes are more likely to be diffused. This is a different approach from the one that drove the five country projects, which had the larger aim of increasing the generation of new and often tacit knowledge and the *use* of prior knowledge.

Ultimately the 10 programs make for a somewhat heterogeneous universe in terms of the activities supported, the immediate objectives, and the expected outcomes. With regard to financing, the inputs range from a low 2 million SEK to nearly 200 million SEK, a ratio of one hundred, while the time period ranges from one year to over 10 years. The type, scale and range of the outcomes are also therefore very diverse.

SIDA'S APPROACH TO RESEARCH AND INNOVATION

The ideas of innovation systems and cluster initiatives provided FORSK with a conceptual tool to combine its role in promoting capacity development in research with supporting the goal of Swedish development assistance to improve conditions for sustainable economic growth processes in poor, developing countries, and to produce greater impact. The Triple Helix model brings together the expertise and experience of universities, business enterprises and governments to facilitate collaboration and innovation. Sida used the Triple Helix model of innovations for the five national level interventions. VINNOVA is a Swedish model for promoting sustainable growth by funding needs-driven research and the development of effective innovation systems. Sida employed the VINNOVA model for the four Cluster Initiatives. Sida defines innovation in terms of the use of ideas, technologies, or ways of doing things that are new to a specific context. Innovation requires interaction between researchers, industry and political bodies, along with effective communications, networks and partnerships across organizations and channels. Universities are potentially powerful vehicles for promoting development, but in many low-income countries, links between universities and other actors is often weak. Sida's work positions it well to assist in systematically organizing and accelerating the development process.

PRI's evaluation discusses the increasing popularity of cluster strategies (see glossary) in the European Union and other OECD countries, as an important economic development approach. A number of Cluster Initiatives have also taken place in developing and transition countries. The latter have largely been donor-led initiatives, more often focusing on firm competitiveness, with less work on linkages with knowledge systems as found in the Sida portfolio. There is, however, uneven interest and engagement with the ideas of innovation, and research into innovation in or for poor countries, among donors and over time. This suggests that there would be great value in further work by Sida, in partnership with others, to refine these ideas.

LESSONS FROM RESEARCH ON INNOVATION AND GROWTH

PRI identified general lessons from the research that are relevant for supporting innovation and growth projects:

- Working and reworking the existing stock of knowledge to generate local innovations is the dominant activity in innovation in poor countries.
- Innovation requires effective communications and constant interactions between suppliers and users of research-based knowledge.
- Networks, coalitions, and partnerships across organizations and channels are important supports to innovation.
- "Systems thinking" requires defining appropriate systems and gathering knowledge of their interactions. Programs must work with a range of actors, at multiple levels and have flexible linkages to ensure interventions are balanced, flexible and iterative.
- Understanding partners, their institutional rules and incentive frameworks, requires greater use of participatory processes.
- Meeting the needs of knowledge users is a labour intensive process.
- Most firms seeking to innovate draw on knowledge first from other firms. Only after they build their internal capacity do they become motivated to interact in significant ways with research organisations.
- Linking research and development organisations to innovation in industry is very difficult in poorer countries. The poorer the conditions, the weaker the links within a "system of innovation".
- Research funding agencies should recognize the need to understand the dynamic interplay between the "supply" of new ideas and knowledge from research and the "demand" from the potential users. They should be aware that innovations, therefore, require links and interactions between the organisations and actors on the supply and demand side and innovations and growth result from diverse factors and complex interactions. The innovation systems concepts offer a richer understanding of the factors, their interplay and sometimes useful prescriptions, but do not provide for easy policy prescriptions. More research and experimentation is required on desirable public policies that aim to promote innovation as well as the effects of such policies in poor countries.

HIGHLIGHTS OF FINDINGS

All the projects in the portfolio were found to be highly relevant and notable in their role as vehicles for promoting wider learning within various groups. The broader assessments made by Sida staff in 2006 for the five country initiatives were excellent (almost all the objectives and hypotheses held in the four more successful cases). The majority (four out of five) of the country projects were judged to have been relatively efficient to highly efficient. A majority (three out of five) were mostly effective in increasing institutional and human capacities. Efficiency is defined as how economically resources are converted into results and effectiveness is defined as the extent to which objectives are achieved.

Other important outcomes observed in the five countries (especially Tanzania and Uganda, where there has been greater time to achieve results and also greater prior government interest) include:

- Improvements in government policies;
- Increased support to cluster firms (Tanzania and Uganda); and
- Economic benefits across multiple clusters (Tanzania and Uganda).

Monitoring remains a critical deficiency across the portfolio. Improved monitoring does not imply more financial audits (the most frequent type of review). The information from the monitoring should be directly useful, providing information to management to improve the operation of the project. Similarly more rapid and better quality evaluations should not be interpreted as more mandatory reports at specified times. Evaluations, focused on impact and/or accountability, should lead to on-going quality improvement.

The selection of activities supported in the portfolio indicated good judgment and capacity at Sida. The shortcomings were very low linkages between activities in the portfolio, the lack of an agreed upon "theory of change" across the portfolio, and a lack of systematic attention to learning, quite often within interventions and, almost always, across the portfolio. The ideas and theories of innovation build upon and call into play a requirement for increased capacity at Sida and its partners.

STRATEGIC CONSIDERATIONS

The evaluation confirms a number of key points about innovation and growth that will be important for Sida to consider in moving forward:

- Government policies that prioritize economic growth also prioritize innovations.
- Innovations in poor developing countries are most often "local innovations" that increase efficiency in production, reverse engineer products and translate available knowledge to local contexts.
- To increase growth rates in poor countries it is important to link traditional and indigenous knowledge and to integrate competencies and skills from traditional sectors with modern knowledge. Increased external links to relevant know-how are important and can be supported by Sida; however, they carry potentials for both negative and positive outcomes.
- In poor countries firms tend to be weaker. The innovation systems are more dependent on public policy as the demand side is weaker and the systems more fragmented; and the role of civil society organisations in promoting innovations can be more important than in richer countries.
- A systems framework facilitates the examination of obstacles to improved performance and the development of a way to prioritise alternatives. It makes it easier to determine the most appropriate interventions and to plan a proper sequence of events.
- The new knowledge theories and Triple Helix concepts provide a useful method for Sida to combine research and capacity building with short- and long-term poverty reduction outcomes.
- The IS/Triple Helix/CI approach provides additional co-benefits of increased trust and social capital, important factors that promote growth, and also contribute to improved governance.

RECOMMENDATIONS

Sida is again at an important moment of transition and restructuring and is highly constrained. What is required is a space within Sida's structures for addressing interdisciplinary and systemic problems. This could include managerial, personnel and incentive structures that, rather than obstructing individuals and programs, work effectively across organizational structures at Sida and its partners. This is consistent with Government of Sweden's instruction to Sida

to make room for flexibility and innovation in its contributions, to support partner countries interested in innovation, and to encourage innovations in the work processes within Sida.

Essentially, the ideas and theories of innovation call for an increasing capacity of Sida and its partners for managing change. Change processes are inherently difficult to monitor and evaluate, and always require a more flexible and evolving process of planning for change. This appears to pose challenges for Sida processes. Sida needs to improve internal processes along the lines stated earlier.

To achieve greater efficiency and effectiveness, Sida should leverage partnerships with research funders in the IFORD network who have a shared interest in innovation, economic growth, higher education and clusters. Sida should consider playing a lead in this area. New partnerships are most likely to emerge from documented successes.

The recommended actions include continued support for new knowledge on how the ideas can be extended, and how good practice and policy frameworks can be improved. The extension of ideas and practice should include sharing knowledge within FORSK, then other Sida departments, and finally among partner agencies and countries. For Sida as a whole, the extensions have immediate applications in almost all sectors, but would be especially relevant for higher education, technical training, private sector development, agriculture, natural resources, environment and rural development. At the same time, given that "innovation" has so many forms of use, Sida should not convert their use to a mere slogan. Sida is well-positioned to develop clear definitions of innovation at different levels of applications (e.g. new to a project, new to a country, new to Sida, new to the world).

Political commitment in the organizations that are critical to implementation and appropriate level of stakeholder support are prerequisites for the projects to succeed. Pilot projects, as undertaken in a systematic and step-by-step manner in some of the portfolio, are invaluable inputs to providing practical lessons for Sida support for innovation, and developing policy frameworks, and should be encouraged. Working at the regional levels requires greater attention to institutional arrangements where the layers of administration and links are inherently more complex. This mode requires greater engagement on the part of Sida at the different levels using improved assessments of whether arrangements are working.

Beyond the findings that emerge more globally from the portfolio, there are a number of specific recommendations made for each component of the portfolio. Some principal recommendations consider mechanisms to ensure improvements in design and resource allocation in each component based on the projects' experiences to date. Among the more common recommendations are that Sida should include more types of resources people, with diverse backgrounds and expertise in the innovation projects, increase the numbers of people involved and especially the range and numbers of student engagement in the activities to have wider and sustained impacts. It is also strongly recommended that Sida consider additional steps based on new studies for the Bio-Innovate program to reallocate resources that can improve the potential for innovation outcomes. In all Cluster Initiative projects, Sida and the partners should review and agree to new ways to learn lessons in order to remove obstacles and impediments to previous implementation efforts.

1 Introduction

This section provides the necessary background information on Swedish International Development Cooperation Agency (Sida) and the project. It indicates the purpose of the evaluation, its intended audiences and practical limitation. It describes the scope and organization of the report. It should be noted that it is a forward-looking report that offers insights into how Sida might enhance its efforts to support research collaboration and innovation systems.

1.1 BACKGROUND

Two main developments form the background to Sida's decision to make a strategic evaluation of its portfolio of innovation-related projects funded by the Unit for Research Cooperation (FORSK).[1]

First, Sida notes that "there has been increased attention to innovation systems and clusters. These concepts usually began in high-income countries to address the issues of economic growth and competitiveness. For the same reasons, and also given the central importance of innovation to economic growth and to poverty reduction, the same concepts are increasingly being studied and included in national growth and development strategies of low-income countries." [2] Together with greater recognition of the role of knowledge, there is increased attention on the importance of research and the potentially more central role for universities. This has contributed to growing interest in building the research and knowledge infrastructure. There is also increased acceptance that research forms only

[1] The grants and activities in the portfolio covered in this evaluation have different commencement dates. The activity with the longest history of support began in 1997. Between then and now, the responsible body within Sida for research cooperation has changed names several times. It was known as SAREC until 2008 when it was renamed the Secretariat for Research Cooperation (FORSKSEK). As of January 2011 it has been named as the Unit for Research Cooperation (FORSK). For simplicity this report will use its current name, irrespective of the appropriate name at the time of any particular decision or activity on behalf of Sida, with the exception made when quoting text or referring to document titles that use one of the other names than the current one.

[2] From the Terms of Reference for this evaluation, see Annex 4.

one component of the so-called "National Innovation Systems" (NIS) and that improving innovative outputs for growth requires attention to additional system components beyond research and higher education. Sida also notes that applications of these concepts in developing and low-income countries must take place under conditions very different from those in high-income countries. The above observations raised two questions for Sida. First how could it best plan its research cooperation activities to reflect the increased attention and demand for investments in national innovation systems? Second, what is the relevance of the new ideas for partnerships developed under the "Triple Helix" and "Cluster Initiatives" (CI) approaches?

Second, the most recent strategy (2010–2014) for Sida's support to research cooperation explains that one of its objectives is to encourage "opportunities for utilizing research as a tool of development" and that those opportunities are to be "enhanced by such means as investment in innovation systems".[3] The emphasis should be on support for fora and functions that facilitate the exchanges of information between the research community, the business community and society at large".[4] It adds that the objective to build research capacity in low-income countries is to be explicitly based on "a systems oriented approach to higher education, research and innovation" and activities should focus on "ensuring that research has a greater impact on the fight against poverty as a result of cooperation between universities, public authorities, the business sector and civil society".[5] Hence, one intent of the evaluation is that it should assist Sida in formulating work plans that better reflect the innovations systems perspective.

1.2 PURPOSE

Against this background, the main purpose of this evaluation is to generate knowledge and to identify key lessons from the experiences and results of the portfolio projects that will inform and support FORSK and Sida more broadly, providing guidance on how best to

[3] Government Office of Sweden, Research for development: Policy for Research in Swedish Development Cooperation 2010–2014 and Strategy for Sida´s support for Research Cooperation 2010–2014, The Department for Development Policy and the MFA Information Service, Stockholm, 2010.

[4] Ibid, p. 2

[5] Ibid, pp. 3–4.

work with research in relation to innovation systems and cluster initiatives in the future.[6]

1.3 QUALIFICATION

The evaluation is strategic in nature. It asks evaluative questions about a portfolio of contributions in order to assess the different "ways of working" for Sida represented, but does not evaluate the results of each contribution *per se*.

The timing of the evaluation is driven by Sida's need for guidance and a coherent analysis of the portfolio, rather than by the needs of each individual contribution. The projects differ considerably in duration and, therefore, in the potential range of outcomes and impacts. Generally, interventions sustained over longer periods should have stronger evaluative results. Nonetheless, the methodology applied to the entire portfolio follows sound evaluation practices, lending credibility to the results as a whole.

1.4 USERS OF THE EVALUATION

There are three main audiences for the report. The first and primary audience is FORSK and other concerned departments at Sida. The next audience is comprised of donor agencies with a shared interest in learning more about how to address issues regarding innovation systems and cluster development. A third audience includes researchers and developing country partners and stakeholders, engaged in work on innovation systems and cluster development, and seeking to make better use of knowledge inputs for growth and poverty reduction.

1.5 SCOPE AND ORGANIZATION OF REPORT

This report is organized to allow for several objectives that must be fulfilled simultaneously. Chapter One describes the purpose and universe of the evaluation. Chapter Two provides details on the portfolio, methodology, work plan and timeline, and other operational details. Chapter Three provides a short overview of the theory relating to innovation systems, innovation and growth, the use of research, Triple Helix and Cluster Initiatives. Chapter Four presents the main findings for the questions posed by Sida. Chapter

[6] From the Terms of Reference, see Annex 4.

Five presents the main conclusions and Chapter Six summarizes the recommendations. There are four annexes, providing the references to the documents listed in the main report, definitions for some of the technical terms used, the complete Terms of Reference for the evaluation project, and the biographic information on team members.

A separate report, contains detailed information on each individual case in the portfolio: history and developments, findings, outputs, outcomes, conclusions and recommendations. Where applicable, the results from the surveys of project stakeholders are also included. These details (in over 200 pages) are provided to make the overall findings transparent, and to make it possible for specific stakeholders to easily access in-depth information about their particular projects. The names of all persons interviewed are listed in that volume of cases and the material in the cases is used in summary form in this main report.

1.6 ACKNOWLEDGMENTS

The evaluation team is grateful to many people for their cooperation and assistance during this process. We record our thanks to the many individuals who generously gave their time. Those whom we met and interviewed, including some with whom we only had telephone conversations, are listed in the volume on individual cases. Those who participated in the different surveys, almost 300 persons in all, are not listed individually, but we are grateful for their enthusiastic participation. Also largely anonymous are a similar number of individuals who are among the ultimate beneficiaries of the programme, the many men and women, many of them poor, who work in the cluster enterprises. Many work individually or with family members in relatively small production activities. They met with us with great enthusiasm, and discussed their experiences at considerable length. The value of the time they spent for our interviews was notable, and confirmed their positive experiences as the intended and ultimate beneficiaries of the interventions.

We also wish to thank the members of the evaluation team of Sida, especially those in the Management Group, the Reference Group and the Consultative Group for their time, patience, and thoughtful comments. Special thanks are due to Pernilla Sjoquist Rafiqui, who went beyond her duties as manager to provide many

detailed comments and suggestions and ensured wide participation within Sida through several meetings with staff. Finally, it is only appropriate that while working on the topic of innovations and networks, we should acknowledge the accidental meeting with a dedicated researcher working on a Ph.D. on clusters at Lund, Jens Sörvik. We are grateful to him and to many others, for sharing their knowledge on innovation systems and clusters and also some of the relevant literature.

2 The Portfolio and its evaluation

The evaluation covers a portfolio of ten distinct programs (some with sub programs) that have received support from FORSK. A schematic sketch is shown in Figure 1.[7]

FORSK[8] stated that it first engaged in innovation systems and cluster work in 2003 by supporting delegations from partners in Mozambique, Tanzania and Uganda to attend an international conference on innovative clusters – the 6th Annual Conference of "The Competitiveness Institute"(TCI) on Innovative Clusters held in Gothenburg.

This led to an initiative by the three national universities to organize a 1st Regional Conference on Innovation Systems and Innovative Clusters in Africa, in Bagamoyo, Tanzania in 2004. The Bagamoyo conference in turn led to the proposal, "Innovation Systems and Clusters Program for Eastern Africa" (ISCP-EA), with the main objective of stimulating and facilitating the development of innovation systems and innovative clusters in East Africa. Funds were provided for work in Mozambique, Tanzania and Uganda.

This led to several workshops organized within the framework of the ISCP-EA, assisted by an advisory team from the Swedish Governmental Agency for Innovation Systems (VINNOVA).[9] The ISCP-EA program engaged primarily with the national universities with the objective of stimulating, catalysing and promoting the

[7] Note that almost all projects do not stop at the date specified as often activities are delayed and Sida allows the projects to continue within the agreed framework and resources. This has happened for example in Nicaragua and BIO-EARN, where the activities did not conclude in the time specified. They continued further within the allocated budget to complete them, while decisions were made on any possible new phase or termination. It is also important to note, that several projects such as the ones in Bolivia, Mozambique, Bio-Innovate, PACF continue on beyond the year 2010, which is the end date used in the figure. New grants that start in 2010 have been approved for Tanzania. More details on each are available in the case studies volume.

[8] Where not otherwise noted, "statement" in this section refers to the statement of work in the ToR for this evaluation.

[9] VINNOVA's supporting role was subsequently transferred to the Scandinavian Institute for Competitiveness and Development (SICD) at the Blekinge Institute of Technology.

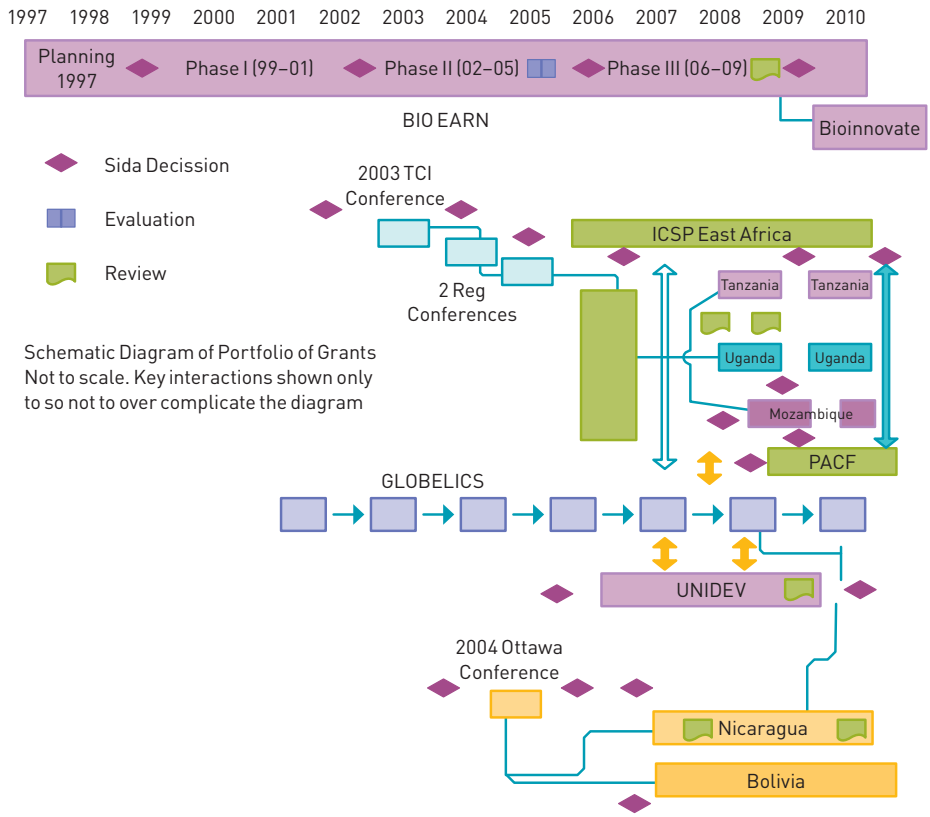

Figure 1: Portfolio Description and Evolution

development of innovation systems and innovative clusters in Eastern Africa, in turn to facilitate speedy socio-economic development and poverty reduction in the region.

The ISCP program provided a platform for conferences, workshops, and training. It followed the Triple Helix and Innovation Clusters methodology discussed in greater detail in Chapter Three. ISCP-EA has three components: ISCP-Tanzania with Sida contributions of SEK 3,560,000 for the period 2005–2009; ISCP-Uganda with similar Sida contributions; and ISCP-Mozambique, begun a little later, with Sida contributions of SEK 2,250,000 for 2006–2009.

As indicated in Figure 1, the Pan African Competitiveness Forum (PACF) is a relatively new organization that emerged from the ISCP activities and from the collaboration with The Competitiveness Institute (TCI). The results and experiences in East Africa, and the support of TCI, encouraged the key stakeholders in ISCP to set-up

a regional/continental forum for "competitiveness" in Africa. It was launched at a conference organized in cooperation with the African Union Commission Directorate for Industry and Trade on April 16, 2008, and was attended by 110 people from the different sectors relevant to Triple Helix work. The participants were from 22 African and ten other countries. A follow-on conference was organized in 2010. The Sida contribution for the period 2008–2010 was SEK 3,070,000. These four programs focussing on Africa are all outcomes of the TCI conference support of 2003.

The National University of Rwanda (NUR) submitted a proposal to design a similar innovation and cluster program. Sida rejected this proposal in March 2009, recommending that NUR formulate a new proposal for future agreement with Sida.[10] For this reason, it is not shown in the diagram of programs and grants.

Encouraged by the CI developments in the African countries and the support for the initiative at the Bagamoyo conference, both of which were outcomes of the 2003 TCI conference, Sida sponsored 16 delegates from Bolivia, Honduras and Nicaragua to participate in the 2004 TCI Conference on Innovative Clusters held in Ottawa.[11] Linked to this, researchers from Chalmers University of Technology worked on an "action learning" research project, with stakeholders in the three Latin American countries, based on the "Innovation Cluster Model", with primary partners at the Universities.[12]

Discussions between Swedish partners and the local universities led to new two projects in 2007. In Bolivia, the Innovation Project (IP – Bolivia) was launched, with similar objectives as in Africa, using a Triple Helix and support for the cluster production chains

[10] Originally the plans called for the inclusion of the case of Rwanda in the evaluation. It was agreed during the first set of meetings at Sida in September 2009 that the evaluation of an activity that was rejected and did not happen, posed very different set of issues to the set of activities that have been accepted and have been undertaken through collaboration among multiple partners. The decision was taken by Sida to focus on the latter set and to drop Rwanda from the evaluation.

[11] Participants included 7 persons from Bolivia and three each from Nicaragua and Honduras; mentioned Alänge, Sverker, and Sari Scheinberg, *Innovation Systems in Latin America: Examples from Honduras, Nicaragua and Bolivia*, Sida Report Series, Stockholm. 2005, p. 57.

[12] See Alänge and Scheinberg, 2005, p. 20. The report also notes that there was a need to revise the model to better incorporate local context and this required the addition of unions in Honduras; the donor community in Nicaragua; and the indigenous communities in Bolivia.

method in collaboration with VINNOVA and SIDC/Blekinge Institute of Technology, Sweden. The Sida contribution was SEK 1,260,000 for 2007–2010.[13]

In Nicaragua, the "Innovative University Program" (IUP) was launched, with the continued partnership of Chalmers University. Chalmers, with ten University members of the "Consejo Nacional de Universidades" (CNU), jointly created the IUP-Nicaragua proposal. As a result of the primary motivation of the partners, the objectives and methods adopted in Nicaragua differed from the work in the previous four countries. The goal was to stimulate and strengthen Nicaraguan universities to engage in partnerships with *key stakeholders* in order to redress, the under-utilization of domestic research in Nicaragua, through the generation of knowledge, cooperation and innovation.[14] This project followed a methodology developed by the Chalmers University of Technology. Sida made a contribution of SEK 8 million for the period 2007–2009.[15]

The activities supported in the three Eastern African countries and in Bolivia all engage directly with the key stakeholders identified in the Triple Helix and CI models: universities, private sector, and

[13] The ToR state the Sida contribution as SEK 1,260,000 while the assessment memo states it to be SEK 2 million.

[14] The proposal said the objective was – "To develop and drive an action learning program over a 2 year period that will support the CNU and the 10 leading Universities in Nicaragua in creating (or strengthening) their role, position, competence, structures, management practices and relationships (partnerships) with their key stakeholders (Government Agencies, Industry, Unions, Communities, Financial institutions, NGO's, Media, etc.), in society that are needed for contributing to the prosperity of Nicaragua through generating knowledge, cooperation and innovation".

[15] The proposal states that an action learning methodology will be followed that supports and builds on the priorities in the universities and CNU that demand further development of the relationships, conditions, structures and processes to make the Universities in Nicaragua to be more innovative. The theory is listed as the "Cycle of Experience" as developed by Scheinberg and Alänge (1997, 2000, 2004, 2006) includes the following stages for a complete learning experience: sensation (feelings, worries, trends, issues), awareness (what are the facts, priorities, goal setting), mobilizing of energy (planning and acquiring the resources needed), action (doing), contact (keeping in touch with self, others and goal), reflection-analysis (what are the results of goals and process, mistakes made, learning), integration-standardization (how can we use what we learn in our current work or organization), closure (unfinished business defined, celebration or mourning)". The references are not provided in the proposal.

government bodies, both local and national. In these initiatives, cluster facilitators are engaged and trained in order to foster linkages between the stakeholders. Nicaragua has similarities in that its post-project outcome is to promote innovation, and the approach indirectly concerns the same set of actors. The entry point and focus of the program is, however, the university sector, and the methodology is also different. Rather than seeking to construct clusters, the project activities aim at strengthening Nicaraguan universities to engage in partnerships with other key stakeholders in order to pursue activities of mutual interest.

Two very distinct projects that Sida has included in the portfolio are BIO-EARN and Bio-Innovate. BIO-EARN provided for research training and capacity building within a scientific research network for Biotechnology, where it was expected that after the training and capacity building, the enhanced research capacity would lead to innovations in new products and processes. BIO-EARN was designed in 1997 with the Stockholm Environment Institute (SEI). The program was initiated in 1998 in four partner countries, namely: Ethiopia, Kenya, Tanzania and Uganda. It aimed to develop their capacity "to effectively and efficiently use modern biotechnology in agriculture, industry and for environmental management." BIO-EARN operated for three phases, with the third phase scheduled for completion in 2009. This was concluded in 2010 with total Sida contributions of 172 million SEK over the period of the three phases. Since then a new program, Bioresources Innovations Network for Eastern Africa Development (Bio-Innovate), has replaced BIO-EARN.

The Bio-Innovate programme has been established with a new secretariat, a multidisciplinary platform or framework, and a competitive funding mechanism to support product-oriented biosciences innovation activities. The countries in the network have been expanded to include Burundi and Rwanda. Bio-Innovate is characterized by a focus on the "applications of bio-resource innovations to support sustainable growth and transformation of the agricultural and environmental sub-sectors from primary production to value addition, while enhancing adaptability to climatic change and strengthening innovation policy." The Sida contribution over five years (2010–2014) is for 80 million SEK.

Apart from the aforementioned PACF, the portfolio also includes two research and dissemination networks that connect to "Innovation System" concepts; the UNIDEV and Globelics research networks (Figure 1).

UNIDEV is a policy research network first supported by Sida and then by the Canadian International Development Research Centre (IDRC). This is a network for researchers on "Developing Universities – The Evolving Role of Academic Institutions in Innovation Systems and Development" (UNIDEV) that is analysing the future role of higher education in 13 countries. The Sida contribution for 2005–2009 was SEK 7,500,000.

Globelics is a network of scholars who study and apply the concept of innovation systems. It is a forum for presentations of new research findings and reviews as well as a platform for launching new research undertaken by international research groups. The 'Learning, Innovation, and Competence Building System' is the analytical framework of Globelics, and it is especially dedicated to strengthening these concepts and building capacity in the South. Sida provided travel grants to the Annual Conference of Globelics for around 25 researchers from low-income countries each year from 2006 to 2009 (in total SEK 1,200,000).

The ten interventions have also had some but limited linkages between them. The interventions could be grouped into four major ways of working for Sida, each representing an approach to working with the use of research and innovation systems: [16]

1. Four countries (Uganda, Tanzania, Mozambique and Bolivia) and one network (PACF) are experiments using the Triple Helix methods for the development of innovations in CI.
2. One country (Nicaragua) experimented with a "stakeholder approach" [17] to strengthen the universities and their coordinating

[16] Definitions of the words research, innovation and knowledge are provided in Annex 2.

[17] An email from project coordinator stated this was developed at Chalmers University, and was protected under its "intellectual property" and is thus confidential.

body to engage in partnerships with other key stakeholders to promote innovations.[18]

3. In biotechnology, two initiatives (BIO-EARN and Bio-Innovate) provide an experiment wherein the more traditional research support efforts by Sida for sandwich training and capacity building, albeit in a new field of science, are extended so that the enhanced capacity can provide the base for an innovations platform.
4. The two other initiatives are policy research networks – one to understand the role of Universities in innovation processes (UNIDEV), the other a global forum and capacity building network for researchers engaged in understanding the role of innovation in development processes and policy (Globelics). They do not aim to promote innovations directly.

To summarize, the ten programs make for a heterogeneous universe. The heterogeneity is expressed through several attributes, which we have distinguished above. Four aim to experiment with Triple Helix methods for generating innovations; one starts with the same premise, but works only to strengthen one element of the system (the universities); one is traditional in all aspects, except the focus on a new field of science; and then we have two that follow well established traditions of social science research within networks of researchers.

Their heterogeneity has additional dimensions. First, there are key differences in the activities supported, the immediate objectives, and the likely outcomes among them. Second, the efforts vary in the size of the financial inputs, ranging from a low of 2 million SEK to almost 200 million SEK, a ratio of one hundred, which means that they would be expected to have a fairly

[18] It may be useful to clarify here that both 1 and 2 share in their definition of innovation and the underlying theory of change, but they represent different ways of working and hence different activities. The first group uses the Triple Helix model explicitly and works to strengthen interactions by Triple Helix stakeholders through building Cluster Initiatives. In Nicaragua, the use of the Triple Helix model provided a first framework, to which additional stakeholders, considered relevant to the country, were added in the preparatory phase for the 2004 TCI Conference. The project as implemented then followed the "stakeholder approach", but focused on the University sector in order to strengthen this sector and its ability to interact with the other stakeholders inside and outside the University.

wide range in the type, scale and intensity of their activities. That in turn should result in a wide range of output levels and outcomes. Third, the time period, during which each intervention has been operational, ranges from one year to more than ten years, and the time factor is important for defining the scale of outcomes and impacts. Combining the differences in resources and time, the largest intervention had the potential for one thousand times the scale along the "outputs" and "outcomes" space than the smallest intervention. This heterogeneity posed severe challenges in terms of study design. The evaluation strives to report on the portfolio with sufficient granularity so as to be useful to all audiences (e.g. provide appropriate attention to and detail about both the portfolio and each intervention.)[19]

2.1 METHODOLOGY

The evaluation began with two parallel activities that led to the inception report. Sida required the evaluation to address the definition of innovation systems and clusters and to reflect upon Sida's use of the terms in the portfolio of programs included in the evaluation. Sida also required a review of the activities of selected donors and research funders engaged in similar initiatives. It requested that emphasis should be put on clarifying the particular nature of "innovation systems and clusters" in the context of low-income countries, and how such countries might benefit from research cooperation. Chapter Three provides a short introduction to the innovation systems concept, its relevance to the work supported by Sida, and the overall theory.

In parallel, the Policy Research International (PRI) Team collected and reviewed the relevant information concerning Sida support to the portfolio of activities,[20] largely based on available

[19] This challenge and strategies for resolution are taken up at several points in the report. See table one below, on the summarised articulation of the methods used for each intervention within the portfolio; and table two for the Logical Framework that was derived based on documents.

[20] Activities are "[a]ctions taken or work performed through which inputs, such as funds, technical assistance and other types of resources are mobilized to produce specific outputs". OECD, *Glossary of Key Terms in Evaluation and Results Based Management*, 2002, reprinted 2010, p. 15.

Sida documents.[21] The initial data collection aimed to cover these, together with relevant evaluation and research reports, as available. It was anticipated that this could be completed rapidly, but unfortunately, even by the end of the evaluation, some of these reports could not be made available.[22] The first step in the empirical analysis was the review of the appropriate documents through desk study, interviews with key persons, and electronic exchanges. Brief synopses and key issues to guide the field visits were completed, and then summaries made to map a key evaluation question, namely: how do Sida and its partner organizations learn about the progress made, achievements and challenges, and then make decisions? [23] It was hypothesized that there would be a loss of efficiency in individual and joint decision-making, especially where changes and modifications of design and plans were required, if documents were not easily available and of adequate quality. The table below summarises the methods used for each case study, some limitations and factors that led to the choices, as well as the countervailing positive factors that mitigate the limitations.

[21] Sida routines specify the following steps for each grant: the proposal by the recipient; the proposal "Assessment Memo" by Sida; the Decision Memo; and if approved the resulting agreement document. This specifies the tasks, budgets and responsibilities of the partners. During the agreed-to contribution period, there is a requirement for Annual reports, which provide reports on the progress of planned activities and outputs, together with financial reports submitted to Sida.

[22] They are mentioned in the cases of the individual contributions in the annex, when relevant.

[23] It should be noted that Sida is not the focus of the evaluation, but its role emerges from the question in the ToR – how should Sida work best with innovation; what mechanisms are in place/or needed; what hindrances are there, etc. – especially, as we will see, from the review of the theory in Chapter 2.

Table 1: Summary of methods and limitations

	Case	Methods	Limitations of the method	Positive Factors
1 2 3 4	ISCP – Mozambique ISCP – Tanzania ISCP – Uganda Bolivia	Review of documents, interviews, discussions, focus groups and fieldwork, as well as surveys conducted with participants and beneficiaries. In all cases, a fair number of interviews with diverse participants were conducted. This group received the maximum attention as the work in this area, especially with the "Triple Helix" method, has been relatively new and less studied and reported on.	No base line data for comparisons. Firm level outcomes not quantified by economic values. Modest to poor response to electronic survey. Additional components of, and linkages to, much larger bilateral research support with the same institutions not examined.	Visits to actual clusters and firms, numbers visited, sufficient number of persons interviewed and visited and the variety of stakeholders. Longer interviews with coordinators and key stakeholders.
5	IUP – Nicaragua	Review of documents, interviews, discussions, focus groups and fieldwork, as well as surveys conducted with participants and beneficiaries. Same approach as before but without the firm level inputs as firms were not a part of the focus.	No base line versus end of project data for comparison. Survey used was identical to first four cases, but it could have been tailored more to the specific outputs. Modest response to electronic survey.	Several rounds of interviews, and electronic feedback with project coordinators.
6&7	UNIDEV Globelics	Review of documents, interviews, and electronic survey of participants and beneficiaries. The value of network research is relatively well known. Focus here was on the quality of the network experiences, outputs, learning and other outcomes. Electronic survey of participants was deemed to be most appropriate and efficient.	Face to face discussions with coordinators only.	Counterbalanced by excellent response to electronic survey.

	Case	Methods	Limitations of the method	Positive Factors
8	PACF	Review of documents and interviews with key promoters. The value of the network would depend considerably on the value of the work within ISCP and the limited experiences of PACF.	Discussions and interviews with coordinators and a few principal actors only.	It has been operational for a relatively short time and it was judged that a larger effort was not warranted.
9/10	BIO-EARN and Bio-Innovate	Review of documents and interviews. Focus on concepts used in the design, implementation challenges and compare them to innovations systems approaches. The scale and duration of this dwarfed all others and would require much deeper and wider study to do this effort full justice. Given the number of documents, reviews and evaluation that are available, they were supplemented through a set of very long and detailed interviews.	Discussions and interviews with coordinators and a few principal actors only.	Interviews, electronic feedback with project coordinators. Very large number of fairly recent documents, reviews and evaluation that are available and current. Bio-Innovate became operational only in 2010 with few observable outputs.

The evaluation team worked continually to triangulate the summary of the theory of innovations and those on economic clusters that would be most useful for Sida in terms of the work in poor, developing countries together with the fieldwork.[24] A key idea behind the theory of development and the discussions are the formulation of

[24] Often this is stated as the theory of National Innovation Systems (NIS). Chapter 2 discusses the fact that there are a number of alternative perspectives that illuminate the field of innovations and no single theory dominates completely across topics of study and action.

hypotheses of what we expected to see and the view that the closer the match between predictions from theory with the evidence, the greater the confidence we can have in the initiative's potential. The review of the theory, and some field experiences, together with the project documents, provided for a brief "theory of change" that was then used to develop a logic model.[25, 26] The table below summarizes the logic model in terms of inputs, activities, outputs and outcomes or impacts.[27, 28]

2.2 THE RESULTS CHAIN

(see Table 2: Logic Model of Portfolio: Inputs Outputs Outcomes Impacts[29]*)*

[25] A "theory of change" is the theory of, or understanding of the concepts underpinning, how and why an initiative, as in the portfolio being evaluated, works to lead to the anticipated or planned results.

[26] A logic model is a simple framework for describing the relationships between the inputs, activities, outputs and outcomes, and needs to be situated within a theory, though sometimes it is said to be similar to a "theory of change", "program logic", a conceptual map or an "outcome map". While we agree that they share many common features, they are not identical in our view.

[27] Logical framework or Logframe involves the elements (inputs, outputs, outcomes, impact) and their causal relationships, indicators, and the assumptions or risks that may influence success and failure. The definition is found in OECD, 2002, p. 27.

[28] We have used the word Outputs as goods and/or services which result directly from the intervention, including changes of capacity that are required to achieve the outcomes. And "outcomes" are as defined in OECD, 2002, p. 28, which emphasizes achieved effects in the short term and/or medium term of an intervention's outputs.

[29] The ToR required a map of the results chain implied in these contributions, in terms of outputs, outcomes and impacts. It defined direct outputs as results within the control of the programs that were expected by the programs, and by areas such as entrepreneurship, university or research infrastructure reform, policy, etc.; the outcomes are defined as results necessary to achieve the desired impact, but outside the control of the program. We have added the time factor to distinguish between immediate or short term outcomes and those in the medium term, and then have used the word "impact" with its longer term connotation as distinguished under OECD DAC definitions.

Table 2: Logic Model of Portfolio: Inputs Outputs Outcomes Impacts

	Case	Inputs	Activities	Outputs	Outcomes (short term)	Impacts (long term)
1	ISCP – Mozambique	Financial resources. University -management, coordination, knowledge & skills. Swedish knowledge & experience inputs via VINNOVA/SCICD. Volunteer facilitators Support from "Triple Helix" organizations.	Analysis and studies of clusters. Research. Meetings and workshops. Training workshops (e.g. for cluster coordinators). Formal training for Masters and PhD (Bolivia). Training of researchers to transfer knowledge. Targeted knowledge transfer for policy or for production. Exchange information.	Reports. Networks across knowledge, policy, production and infrastructure domains. Improved information on production, markets, technology. Trained coordinators. Increase in human resources – who then transfer and spin-off knowledge and research results. Improved human resources. Knowledge transferred.	Actions taken based on analysis or study activity. Learning from portfolio Capacity building of triple helix partners. Improved coordination of cluster, trust, knowledge links. Increased and improved courses, graduates and other trainees, research and problem solving. Increased knowledge transfer Improved quality and relevance. Better understanding of problems and arrival at new solutions.	Sida – Improved efficiency and effectiveness of interventions for economic growth and use of knowledge. Firms – Improved policy and support services. Increased innovations – outputs, efficiency, jobs, incomes, productivity. University – expansion of pool of skilled human resources. Engagement in local problem solving, better research outputs. Government – Improved engagement in local problem solving, policy, knowledge and support. Economic growth – increased outputs, efficiency, social capital, jobs, incomes and revenues.
2	ISCP – Tanzania					
3	ISCP – Uganda					
4	Bolivia					

	Case	Inputs	Activities	Outputs	Outcomes (short term)	Impacts (long term)
5	IUP – Nicaragua	Financial resources. CNU management, coordination, University knowledge & skills. Swedish knowledge & experience inputs via Chalmers. Support from "stakeholder" organizations.	Meetings and training for partners, goal development Team building Models and approaches – Universities in innovation systems. Cycle of Experience. Relationship-based Learning. Identification of status and needs. Policy and strategy development – research, researcher. Technology Transfer systems. Link to organisation, strategic alliances, roles and responsibilities. IP strategies and processes. Benchmarking trip. Curriculum development. Evaluation and reflection. Feedback. Diffusion of learning. Standardize new routines.	University commitment. Development of goals and priorities for research and innovation. Results of Needs analysis of key customers. New policies, practices and measures, supply mechanisms. Make key strategic alliances. Implementation of IP processes. Promotion and diffusion process. National regional or International. Conference and presentations.	New knowledge. Policy change at Universities and CNU. Use of benchmarking data and process evaluation to improve University responses to user demands. Assumed outcomes over time: Increased and improved courses, graduates and other trainees, research and problem solving. Increased knowledge transfer. Improved quality and relevance. Better understanding of problems and arriving at new solutions.	Long term – similar to above.

	Case	Inputs	Activities	Outputs	Outcomes (short term)	Impacts (long term)
6	PACF	Same as in ISCP East Africa. Additional management, coordination, knowledge & skills – from new and other countries in Africa; additional volunteer facilitators and "Triple Helix" organizations in new countries.	Analysis and studies of clusters. Research, meetings and workshops. Training workshops such as for cluster coordinators. Exchange information.	Reports. Build networks across countries. Trained cluster coordinators Use human resources from ISCP. Knowledge transferred. Clusters supported in new countries.	Expansion and scaling out of cluster initiatives over wider range of countries.	Improved economic growth and use of knowledge across many countries.
7	UNIDEV	Financial resources Lund University management, coordination, Social science knowledge & skills. Links to "user" organizations and Globelics. Support from other donors.	Periodic meetings Conduct and present research. Critique methods and findings. Links to network of researchers on common problem. Focus on role of Universities in innovations and development. Interact with users of research	Meetings Workshops. Improved research knowledge exchange. Improved knowledge of Universities' role in innovation and development.	Greater capacity for research and policy on innovation systems in developing countries. Greater application of knowledge for policy making to promote innovations. Wider pool of resources and human capacity through training by new researchers.	Increased application of knowledge on innovation systems to contribute to sustainable and equitable development.

	Case	Inputs	Activities	Outputs	Outcomes (short term)	Impacts (long term)
8	Globelics	Financial resources. Globelics management, coordination, manly social science and policy knowledge & skills. Links to "user" organizations and Globelics. Support from other donors.	Annual meetings. Training workshops. Present research. Critique methods and findings. Links to global network of researchers. Focus on innovations and development.	Meetings. Workshops. Training. Improved PhD research knowledge exchange. New ideas and questions followed up by clusters of researchers in the network. Improved knowledge of innovation systems and development. Disseminate research findings.	Greater knowledge and capacity for research and policy on innovation systems in developing countries. Greater application of knowledge for policy making to promote innovations. Wider pool of resources and human capacity through training by new researchers.	Increased application of knowledge on innovation systems to contribute to sustainable and equitable development.

	Case	Inputs	Activities	Outputs	Outcomes (short term)	Impacts (long term)
9	BIO-EARN	Financial resources. SEI management coordination in Phase I and II. Regional management, coordination Phase III Manly agricultural bio- science and elements of other biotechnology. Regional S&T coordination agencies and policy links. Regional Universities and selected Swedish institutes.	Formal training for Masters and PhD. Annual meetings. Training workshops. Provision of laboratory equipment and research materials.	Trained graduates in agricultural, environmental, and industrial biotechnology increased collaboration in technology development and technology transfer partnerships in 15 East African research, development, and policy institutions. Increased awareness on key biotechnology policy issues; development of bio-safety regulatory structures dialogue between the policymakers and scientists.	Enable the countries to: develop capacity in biotechnologies and policies; promote collaboration among stakeholders; address key challenges and opportunities; and promote communication between scientists. Act as a regional "think tank." More effective priority-setting, technology development, and technology dissemination.	Unspecified in Phase I and II Improved local governance and management of research intensive work was not specified but was suggested. In Phase III there were five regional, interdisciplinary new product development projects to provide innovation benefits to the region.

	Case	Inputs	Activities	Outputs	Outcomes (short term)	Impacts (long term)
10	Bio-Innovate	Financial resources. New management, coordination at ILRI. Other partners are the same, but with expansions to two new countries, added inclusion of private sector, a competitive innovation fund with calls for innovation proposals.	Carried over from BIOEARN, training for Masters and PhD. Annual meetings. Training workshops. NEW: New home. Competitive research grants Partnerships. The New Program will undertake policy support analysis studies to provide decision support tools for investment, promotion and management of bio-resource innovations in Eastern Africa.	Four results – original does not distinguished between outputs and outcomes. Crop innovation systems strengthened & innovations to enhance crop adaptability climatic change. Innovations for bioremediation, waste management and mitigation of climatic change developed and promoted. Technology incubation and other mechanisms for putting research into use by communities and industry developed and operationalized. Innovation policies for sustainable harnessing of bio-resources developed and promoted.	Improved productivity and enhance food and nutrition security in the region. Efficient and effective bioscience innovations for environmental clean-up, waste management and sustainable use of resources (water and land) will be generated. Regional innovation systems catalyzed to deliver agricultural, environmental and industrial innovations that stimulate sustainable transformation, utilization and productivity of the region's bio-resources.	An enabling mechanism for mobilization, catalysis and nurturing of a strong bio-resource and science-led economic growth agenda for Eastern Africa strengthened and operationalized. This result will occur as an overall outcome of earlier results.

Sida and its partners have not formally used the above logic map; PRI constructed it from the document review. The research Unit at Sida only began to use program logic tools and methods in 2008.[30] Models or theories of change provide the foundations for monitoring, evaluating and "managing for results," leading to the results chain. [31] Given the recent use of this approach in Sida research cooperation, we were not surprised to find a lack of an explicit model of change in the assessment documents. Hence, we constructed the apparent and linear results chains. In Figure 2, we provide a schematic diagram of how we expect the feedback loops to operate within a longer term initiative lasting several years and phases, as in the CIs, the bilateral project in Bolivia and even more so for BIO-EARN and Bio-Innovate. These feedback loops are ultimately very important for a systems view and for final impacts.[32]

[30] Even where used, we have noted a consistent lack of clarity between the use of outputs and outcomes. There is also little distinction in the conceptual design and analysis of interventions between outcomes that may be immediate, within a short period of intervention, versus those that may take a decade or more, as in the biotechnology case. Given the different types of capacity built through the grants and their very differing time periods, we believe it will be useful for Sida to define the outcomes anticipated over a time dimension. Sida has commented that this lack is not surprising, given that Sida does not use the distinctions of short or long term as a basis for the conceptualization of outputs and outcomes. *Sida RBM Handouts #1 – What are Results?*, 12 November 2009, p. 1, alludes to the time dimension and states that outcomes are a "a prior or intermediate step toward achievement of the objectives". It adds that the "most overlooked and underestimated factor is time" in the Sida RBM framework.

[31] Or as OECD DAC states it – *Managing for Development Results Managing*, Paris, 2009. But it should be noted that the word "Results" is more ambiguous in the evaluation usage, with OECD defining it as follows: "The output, outcome or impact (intended or unintended, positive and/or negative) of a development intervention".

[32] The main difference that OECD, 2002, p. 24, makes for impacts are that they are longer term effects produced by an intervention.

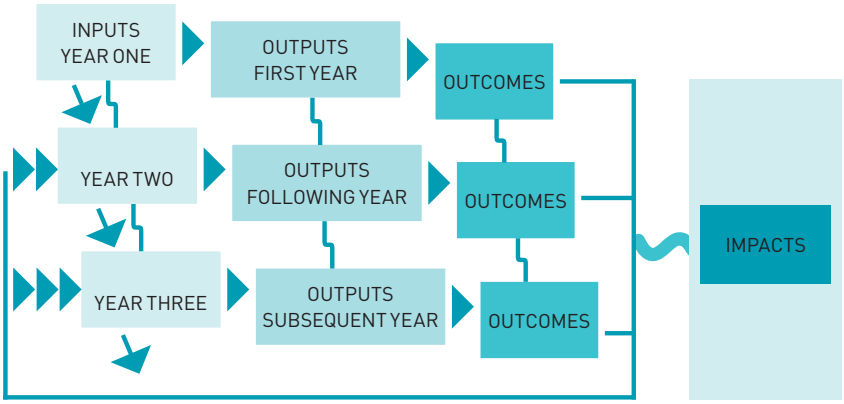

Figure 2: The Results Chain with Feedback

2.3 EVALUATION DESIGN

Based on the logic map detailed in tables one and two, PRI determined that the first four projects above, which aim to promote the economic performance of firms through the use of the knowledge and research capacities of universities via cluster initiatives, formed one group with a common results chain.[33] For these four, the outputs included observed changes in the stakeholder entities that could provide for comparative findings. The Nicaragua intervention could be said to operate on the same premise but with a modified logic; first, there is an increase in organizational capacity of the knowledge production entity and then there is an increase in outputs of *relevant* research, more *efficiently* transferred to users, and leading to innovation in firms. While the Nicaragua project did not specifically state that the outcomes would be available by the end of the project, we considered that the five country projects had a common objective of improving the application of knowledge to show improved economic outputs through changes in stakeholder capacity and could be compared on this outcome. Thus, a common set of questions was developed to investigate the five country-level initiatives.

On the other hand, the BIO-EARN results chain started with training of individual researchers for PhD degrees within

[33] All four follow the innovations models that are generated from the Triple Helix and Cluster theories, which in turn rest on earlier theories and foundations on innovations and economics.

a well-established "sandwich" model, which leads to increased individual capacity. When combined with new facilities and a network, this improved capacity leads to increased research on relevant biotechnologies. This in turn develops new knowledge that is disseminated to a variety of stakeholders, including policy makers, which leads to policy change. Finally, all of these developments together lead to new technologies that are applied to solve problems or to innovation in new products or processes that leads to positive growth effects.[34]

Taken together, the biotechnology initiatives and the country-level cluster initiatives meant that the most important countries for fieldwork for the evaluation were Tanzania and Uganda in East Africa. The next in priority for the portfolio were Bolivia and Nicaragua in Latin America and also Mozambique. Travel was scheduled accordingly, allowing for greater focus on the outcomes in Africa.

The three supported networks in the portfolio – PACF, UNIDEV and Globelics – provided for a different set of issues. They were primarily designed as information and knowledge exchanges for a much larger number of people, and so we would expect their outputs and outcomes to be more diffused. They should all result in improved capacity among the participants through the acquisition of new information, skills and contacts. This in turn should result in new and improved research and knowledge outputs, which should contribute to better policy and action for innovation over time. This is in contrast to the five country projects, which have the larger aim of increasing the *generation of new and often tacit knowledge and the use of prior and generated knowledge*. PACF has the additional objective of increasing the number of cluster initiatives in Africa, but it has only recently begun activities. As such, we determined that it did not allow for an equally in-depth analysis. For the UNIDEV and Globelics networks, PRI used an electronic survey, complemented by interviews with key stakeholder/participants, and taking advantage of other planned travel as feasible.

PRI reviewed selected policy documents and all available documents on the project portfolio, together with selected evaluations of related themes and research activities. The team also engaged in a detailed review of relevant theories of innovations systems and

[34] This intervention follows the classic linear model of innovations discussed in the theory sections in Chapter 3.

clusters. The results chain was often implicit in the documents, and so the theory was used to develop these together with some indicators. PRI interviewed key stakeholders in Sweden and the five countries, focusing on areas not covered in the documents. Seven separate questionnaire surveys were designed to check the hypothesis and outcomes provided by the theory and documents. They were administered to seven initiatives in the portfolio (the five country surveys with common questions plus UNIDEV and Globelics, using different questions).

The overall methodology was to use an iterative and cross-checking process incorporating these types of information inputs (or a triangulation process between the theoretical frame work, the field work supplemented by electronic surveys), with the idea that there would be greater degrees of confidence in the results when and if different data sets and methods led to the same result.[35, 36] The evaluation followed the Logical Framework in devising instruments combined with a systems awareness approach to take into account both the context for Sida and the local context for national and stakeholder organisations. The Results Chain in Figure 2 was kept as a conceptual tool to capture expectations of feedback and learning as the initiatives unfolded over time.[37] The methods used are consistent with the Sida Evaluation Manual, OECD guidelines and the findings from related studies of similar institutions and efforts (such as DFID, IDRC, and the World Bank).

Four tables were created that summarised the tasks and the questions set by Sida, together with the multiple steps and complementary data collection methods followed for the Inception Report. This provided a vehicle to seek further inputs from Sida and the three supportive groups set up by Sida for the evaluation: the Management Group, the Reference Group and the Consultative Group.[38] The revised inception report presented an initial outline, a set of hypotheses, a structure for the main report and a guide to the evaluation.

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35 Largely as suggested in the ToR and the proposal to Sida and then elaborated in the Inception Report.

36 See Sida, *Looking Back Moving Forward*: Sida Evaluation Manual, 2004, p. 114.

37 The terms are used in consistency with OECD DAC definitions and the Sida use as defined in internal documents, where outcomes are "results necessary to achieve the desired impact, but outside the control of the program".

38 Their roles and responsibilities are described in the ToR, Annex 4.

2.4 DATA GATHERING AND ANALYSIS

Following the initial analysis, which helped clarify some of the key issues and expectations, a data collection strategy was formulated to include a minimum of three to a maximum of eight clusters to be visited in the four CI countries. For the five country projects, the aim was to interview key participants at the core of the project, starting with coordinators and then moving outwards to most actors directly involved at the University, followed by facilitators, partners and stakeholder organizations. Further, for each country a questionnaire was designed to follow through on outcomes of the initiatives along qualitative and, where possible, quantitative dimensions. Emphasis was placed on iterative and participatory processes. The participatory process included not only the work within the team, but also the cooperation of partners, directly and through the consultative group, with whom instruments, working hypotheses and interim findings were shared and discussed.[39] The team arrived at their outputs in a fully transparent manner.

Team members undertook field visits during November and December, 2010, using the agreed-upon assessment framework to collect the information.[40] With the preliminary documents as the base, the evaluators conducted individual and group interviews and focus groups. The interviews focused on the partners' and beneficiaries' views on their roles, the outcomes and the impacts, as well as what worked well and what the challenges were. The interviews always included the program managers, members of the project teams, local partners and the knowledge users. During the discussions, the key informants were encouraged to reflect not just on the lessons of the past, but also on ways in which their experience can lead to improved future programming. The list of people consulted and the documents used in each intervention are listed in the volume on individual cases. This volume on cases provides individual narrative reports in detail, together with the survey results (where surveys were carried out). The semi-final draft report and the findings from the individual cases were circulated to all key stakeholders in

[39] Participatory processes are always subject to the concern that the gains in the knowledge and context can be at the expense of objective, independent and expert judgment. The team believes that the triangulation process used avoided most dangers, while adding to the greater accuracy of observations.

[40] Full lists of organizations and individuals contacted are provided within each case study. The countries visited included Bolivia, Kenya, Mozambique, Nicaragua, Tanzania and Uganda.

mid-January, 2011. This was followed by two presentations in Stockholm on January 26 and 27. These allowed for substantive discussions on the main findings, conclusions, and recommendations of the report. The feedback from the workshops (and electronic submissions from those who were not present) has been used to make the final changes.

2.5 TIME FRAME

The team was contracted in August, 2010. The first set of discussions with Sida staff and available Swedish counterparts took place in Stockholm in the first week of September. Following this, the coordinators of all projects were contacted and additional material was collected from them. Following preliminary electronic discussions with the project coordinators, the draft inception report was completed and circulated in early October to Sida and the separately constituted Management, Reference and Consultative Groups. It was presented to the Management Group and discussed in mid-October. The revised final version of the inception report was completed at the end of October, 2010.

Plans for the field visits were firmed up in early November, 2010. The survey instruments were finalized at the same time, including testing. All country visits took place between the fourth week of November and the middle of December, 2010. The surveys were run for the same period, but were extended for several countries through the third week of December to allow for additional responses. Most of the analysis and writing of the draft report took place in January, 2011. The first draft report and the individual cases were submitted to Sida and the Management, Reference and Consultative Groups on January 17. It was also presented to the Management Group on January 27 and their comments and those of project stakeholders were collected in February, 2011. It was revised and largely finalized during March and April, 2011. There were several further rounds of editing for improved readability that continued between May and August 2011.

2.6 CONSTRAINTS AND LIMITATIONS

This report has been prepared under several time constraints given the many consultations and the different project elements that were needed for optimal outcomes. The short time available for the field visits allowed visits to only a small sample of clusters. It required

brief visits and relatively short discussions with the people in the important institutions. Further, the evaluation ran into the holiday season. The electronic surveys in the five countries did not have the response rate that was anticipated. Very few production units/firms were able to complete the survey electronically, but that was compensated for to a certain extent by covering the same questions during interviews with firms.

The time constraints were accentuated by the information and data constraints issuing from the complex record-keeping system in Sida. This prevented timely access to many internal and in-process documents. It does point to one recommendation for Sida management: it is critical to improve the IT system for more efficient retrieval of electronic documents to improve overall efficiency and effectiveness.

The lack of any earlier benchmarks on the different characteristics being measured in the evaluation limited the findings on outcomes. Ideally, goal-level achievements, in particular on changes achieved at the levels of improving outputs, employment and income at the production entities, require baseline data and studies of the situation before and after the intervention. As these do not currently exist, such quantitative assessment cannot be made at this time. Longer-term studies, repeated over the lifetime of the project, would draw better conclusions on "successes" and the factors contributing to them, including cost effectiveness, linkages, and impacts. Longer term and tracer studies are essential for studying the outcomes resulting in capacity developed in interventions such as BIO-EARN. It should be noted that the portfolio of interventions did not provide for the "gold standard" of double blind studies that could provide stronger evaluation results. We believe, however, that within these limitations, we overcame the difficulties by undertaking a bottom-up analysis of individual cases and their work, outputs and outcomes with the theory. As such, we are confident in the value of our findings, conclusions and recommendations.

One team member, Bitrina Diyamett, has participated in several events and activities of the cluster project in Tanzania, in Globelics, and, in UNIDEV. This relationship carries a small risk of bias in her evaluation of the organizations and programs in those interventions. The potential conflict and bias was reduced by her not contributing directly to the assessments and reports on Tanzania, UNIDEV and Globelics. We believe that her prior involvement and knowledge has assisted the evaluation, by adding to its contextual knowledge base.

3 Innovation systems, clusters & Triple Helix

This chapter addresses the requirement to clarify the nature of innovation systems and clusters, their specificity in the context of low-income countries, and how these might benefit from research cooperation. A large number of issues can be covered in such a review and their boundaries are flexible. They include:

- the economics of growth with theoretical underpinnings;
- a vast array of work on technological change;
- research, its measurement and uses;
- several interweaving strands from the above, together with findings from research traditions in sociology and political economy, psychology, and decision theory on the diffusion of knowledge and technology, capacity building, communication and use of knowledge; and,
- individual and organizational incentives and behaviour that provide inputs to different traditions in growth and innovations literature.

The broad overview that follows covers only those key issues that we believe are most relevant for a wide, non-specialist audience at Sida and among key stakeholders for this portfolio.[41] It is not meant to be comprehensive, but aims instead to capture some of the key points from the evolution and history of theory, practice, and application. The intent is to highlight the key insights on innovation systems and clusters, allowing reflection upon Sida's use of the terms, and to consider the special features in the context of low income countries. It also frames these insights so that they provide the key hypotheses for the study of the portfolio and explain the linkages and the channels of influence that contribute to the impact.[42]

The nature and scope of the coverage here is arrived at by "triangulating" between: *i*) larger thematic issue of innovation; *ii*) what the Unit for Research Cooperation has done; and *iii*) the similarities and

[41] Here "specialists" are those who work on innovation and clustering issues as researchers, consultants and specialized staff in organizations and firms involved in innovation and clustering activities.

[42] This was the first set of questions provided in the Sida terms of reference for the study of the portfolio.

major differences to what some related donors have done. Along the way, the Team has also used the emerging data from and about the portfolio itself to determine the issues that are covered.

3.1 INNOVATION IN SIDA POLICY CONTEXT

Promoting knowledge, development and capacity, along with its effective use of is at the core of "innovation for development" and at the heart of the mission for research cooperation. The concern and focus on innovations at Sida emerged from the increased emphasis on growth as a mechanism of poverty reduction in low-income countries, the ultimate goal for a majority of Sweden's development cooperation.[43] The policy statement begins with the following observation: "*Economic growth is absolutely crucial for poverty reduction. There are no examples of countries that have successfully combated poverty without sustained economic growth. Economic growth is an essential prerequisite for long-term poverty reduction and improved living conditions.*"[44,45]

Economic growth is defined in the policy as an increase in the production of goods and services. It is a result of increased labour input, increased capital stocks and improved productivity. The more a country is able to increase total production, the higher the rate of growth, and the more each individual produces with the given factors of production, the higher the productivity.[46] Economic growth means not only increased incomes, leading to higher individual consumption, it also allows individuals and families to improve health and education outcomes. Increased revenues allow the state to invest greater resources in better policies as well as improved social, infra-

43 Ministry for Foreign Affairs, Policy for economic growth in Swedish development cooperation 2010–2014, 11 February, 2010.

44 Ibid, 2010, p. 7.

45 Sida, along with other donors, supported a Commission on Growth and Development as a response to the realization that poverty cannot be reduced in isolation from economic growth. The Commission adds that there is growing awareness that knowledge about economic growth is much less definitive than commonly thought. Consequently, the Commission's mandate is to "take stock of the state of theoretical and empirical knowledge on economic growth with a view to drawing implications for policy for the current and next generation of policy makers." – from Aghion, Philippe and Steven Durlauf, *Growth Theory to Policy Design*, The World Bank, On behalf of the Commission on Growth and Development, Working Paper No. 57, 2009. The commission does include innovations as important factors for growth.

46 Ministry for Foreign Affairs, 2010, p. 8.

structure and regulatory services. Acting together, they result in self-reinforcing and positive systemic effects towards poverty reduction.

The document acknowledges that growth does not solve all problems. For positive developments, growth must be economically, socially and environmentally sustainable in the long term and accompanied by a relatively equitable distribution of the results. It describes the process as beginning in certain sectors (such as agriculture) with increasing added value. This is accompanied by a shift from agricultural sectors to the manufacturing and services sectors for new investments and employment. Thus, productivity growth is essential first in agriculture and natural resources and then in the new sectors.

The primary goal of the policy is to provide *"improved conditions for sustainable economic growth processes in poor developing countries."* [47] It highlights three focus areas for improvement: conditions to enable poor people to take part in growth processes; conditions for the development of markets and entrepreneurship; and the capacity to adapt to changes, threats and opportunities. It recognizes that there are many growth-promoting factors, that they differ from country to country, and that one set of prescriptions does not suit all. The policy document of the Ministry of Foreign Affairs does not use the word "innovation", but innovations are closely linked to and required for growth. Both require a focus on increasing or improving capabilities, financial and social capital, markets and entrepreneurship.[48] This background establishes the need for research support to report results at a higher level than activities and outputs. It also demonstrates that research is a key element of innovations and, as such,

[47] The policy document lays out some of the generic conditions required for economic growth – an institutional framework of rules, including macro-economic stability, sustainable public finances and low inflation, and openness to trade and foreign direct investment; increased social capital of trust and confidence; a well-functioning financial system; and improving the potential of individuals, both men and women, to engage in productive tasks and improve their mobility, all of which are also conditions favourable for innovation.

[48] The document only mentions innovation explicitly in relation to health and access to health technologies by the poor. But innovation concepts are so closely correlated with growth that replacing the word "growth" with "innovation" in the paragraphs above would keep the text coherent. We assume that the reason the word innovation sometimes disappears in economic writings is due to the complicated evolution of economics literature, which would take too long to discuss here, but a common view is that the characteristics of innovation are not easily manipulated using the most common mathematical tools used by economists.

contributes to growth impact. As we see in Section 4.1, this theoretical emphasis on the importance of innovation for sustainable growth – in all dimensions – is as yet not fully reflected in the policy context of Sida.[49]

3.2 THE UNIT FOR RESEARCH CO-OPERATION

FORSK has been assigned the responsibility within Sida to co-ordinate knowledge and capacity development in research issues and *to support partners to better plan, produce and use research* in the fight against poverty.[50] It provides support for research projects and programmes both in Sweden and internationally, and reports to the Ministry for Foreign Affairs.[51] This includes bilateral programs in Africa and Latin America as well as regional and global multilateral programs. The global and regional organizations are supported primarily for their role as producers of new knowledge and as channels for linking this knowledge to the national level.

There was a major review of Sida's research cooperation activities in 2006, which made some recommendations that are relevant here.[52] The review concluded that, while the importance of research and its relevance to development and poverty issues had grown, there were major challenges to the design of research cooperation. It said that the goal of contributing to poverty reduction is not always easy to apply within the goals of research cooperation,[53] and expressed reservations concerning the degree to which the activities of research cooperation have contributed to development impact.

[49] Innovation is more explicitly mentioned in newer strategy documents for tools and funding mechanisms, while the strategy for Research Cooperation, discussed below, puts emphasis on the notion of systems of innovation and places research, universities and higher education within such systems.

[50] Sida, Strategy for Sida's Support to Research Cooperation 2010–2014, Stockholm, 2010.

[51] Sida statement at http://sida.orbelon.com/research-cooperation/about-us.aspx; 17 Jun 2010; Updated: 24 Feb 2011. The Swedish program is to support a Swedish resource base of knowledge of development, and to produce not only new knowledge, but also to provide evidence based policy advice to the Swedish Government.

[52] Eduards, Krister, *Review of Sida's Research Cooperation: Synthesis Report*, Sida Evaluation 06/57, November 2006.

[53] Ibid p. 18.

The review recommended specific activities that would all lead to greater impacts. They were:

- increasing links between research and education;
- strengthening cooperation between university and society;
- utilizing synergies between capacity development and use, by financing follow-up activities;
- using a broader definition of capacity development to include policy development, management, improved cooperation between the public and private sectors, and with users of research results; and
- promoting joint research and innovation policies.

It suggested that greater impact required increased links between various components, processes and actors that are relevant to research and innovation. Further, better links could increase the return on the research and capacity investments.[54]

In keeping with these recommendations and the overarching policy directive of the government of Sweden to support economic growth, the recently adopted Strategy for Sida's Support to Research Cooperation 2010–2014 states that "opportunities for utilizing research as a tool of development are to be enhanced by such means as investment in innovation systems.[55] The emphasis should be on support for fora and functions that facilitate information exchange among the research community, the business community and society at large" (p. 2). Moreover, the objective of research capacity

[54] One report within this group of reviews had highlighted the major changes in the processes for the generation of knowledge and its use, encapsulated in the idea of "innovation systems" should increasingly provide the strategic framework for Sida support to research cooperation. Rath, Amitav and Gunilla Björklund, Mary Ann Lansang, Oliver Saasa, Francisco Sagasti, *SAREC Support to International and Regional Thematic Research Programs, 2000–2005*, Sida Evaluation 06/40, Department for Evaluation and Internal Audit, Sida, 2006.

[55] The overarching document for all Swedish development assistance, including, but not limited to Sida is the 2007 document, *Global Challenges – Our Responsibility*, Communication on Sweden's Policy for Global Development, 2007. It lays out the basic lines of Swedish development cooperation and the thematic areas that are prioritized. Growth is identified as fundamental to all development, and a necessary (but not sufficient) condition for poverty reduction. Interestingly, there was no link made to innovation in the discussion about growth in the 2007 document. Innovation is mentioned in relation to health, and supporting poor people's access to new medicines and health technologies.

building in low-income countries is explicitly to be based on "a systems oriented approach to higher education, research and innovation" (p. 3) and activities should focus on "ensuring that research has a greater impact on the fight against poverty as a result of cooperation between universities, public authorities, the business sector and civil society." [56] Note the increased emphasis placed here on promoting the *use of research*.

We believe that the recommendations made in the 2006 review and the increased demand by the government to show greater use of the built capacity leading to impacts on development are two principal drivers for the increased interest in research into innovations systems. The new innovation system and cluster theories provide a good framework, though not one single and exclusive model or "way of working", for linking education, research and use, which can enhance growth and poverty reduction, matching the high-level Sida goals to specific interventions.

3.3 SUSTAINABLE ECONOMIC GROWTH AND INNOVATION

Here we summarize some of the key insights regarding economic growth as a background to innovations, and the links between these factors. Economic growth, especially the growth in per capita income, is a relatively recent phenomenon in human history and there is much that we do not know about it. In one commonly accepted narrative, economic growth and the rise in per capita incomes began with the industrial revolution in Britain at the end of the 1700s and then spread to Europe and North America.[57]

Another view takes the time of change a little further back, stating that "in fact, economic growth started well before, as a result of the spread of universities in the 14th and 15th centuries, and a series of scientific and technological innovations (e.g., the printing press, progress in ship engineering, navigational instruments, and

[56] The text here from Sida research policy was expanded from earlier versions, as suggested in comments to the draft report, requesting that it makes more evident the relationship between "growth-innovation-research" and to make it clearer in the subsequent discussions for the strategy of Sida, of the links between the portfolio and the evaluation.

[57] Commission on Growth and Development, The Growth Report: Strategies for Sustained Growth and Inclusive Development, 2008, p. 17.

advances in meteorological and astronomical knowledge)." [58] What is common to both narratives is that certain developments in "knowledge and technology", together with increased peace, security and trade, began to provide the preconditions for the per capita growth of income.[59]

Economic growth, its nature and the factors that support it, have been a central concern in the discipline of economics for over two hundred years, beginning with Adam Smith.[60] Historically, the sequence has included the exploitation of natural resources such as agriculture, followed by the rise of manufacturing and then services. The role of increasing specialization of production and increasing returns to scale in achieving per capita growth or productivity were noted as early as Smith.[61] Following him, the thinking about technological change and innovation has built upon findings and observations by economists such as Friedrich List, Alfred Marshall and, notably, Joseph Schumpeter. Subsequent thinking about growth within neoclassical economics highlighted the role of technological change and innovation when the major contribution to growth was attributed to an unexplained driver, beyond labour and capital, called technological change.[62] "Technology" incorporates not only machines, but dimensions of human capital such as education and skills. Some break it down further to include education, experience, "social capital" [63] and intellectual capital. Ultimately, the number of

[58] Ibid, p. 107.

[59] It is worth noting that growth of per capita incomes is a relatively recent human experience. Maddison, Angus, *Contours of the World Economy*, 1–2030 AD. Oxford, UK, Oxford University, 2007, shows that capita incomes for the entire world remained below $1,000 until late 1800s and was relatively constant (or changed very slowly) in the previous two thousand years.

[60] Smith, Adam, *The Wealth of Nations*, 1766.

[61] The famous example is the pin factory provided by Adam Smith.

[62] Solow, Robert, A Contribution to the Theory of Economic Growth, *The Quarterly Journal of Economics*, Vol. 70, No. 1. February 1956., showed that most of growth was attributed to technological change, not capital and labour. It needs to be noted that due to the complexity of the interactions of the multiple relevant factors, the attention by economists to technology in the formal theory of economics has often been uneven and inconsistent. There has been ongoing work to improve upon the Solow model, to increase descriptive powers, to incorporate additional variables with a considerable break through by Romer in late 1990s. But this discussion must be concluded here with the agreement by most economists that "technology" here incorporates additional dimensions of human capital – education and skills.

[63] The stock of trust, mutual understanding, shared values, and socially held knowledge that facilitates the social coordination of economic activity.

factors included varies depending on theoretical purpose, empirical emphasis or school of economics.

Many unresolved tensions remain in theory and practice as to the roles of knowledge, human capacity and technology in promoting an increase in per capita incomes. They include priorities between activities and the proper sequence of various interventions in varying local contexts. Building a new road is relatively simple if money is available, and can rapidly generate increased production by opening market access, thereby reducing poverty. On the other hand, increasing human capacity, such as increasing the number of trained graduates and researchers, requires a longer period of time. The increased capacity could then contribute to growth, but even then the contributions are often indirect and diffused, thus losing out in the competition for scarce resources. The same tensions are observed between different options for increasing agricultural productivity. Investing in improved irrigation can often have rapid and direct impacts, while developing new seed varieties or improved practices are often neglected as the results chain is more uncertain and usually has a longer time frame for their impacts. This is unfortunate, as new techniques can potentially have deeper and more far reaching impacts.[64]

Manufacturing industries have often been prioritised in the literature and policies on technology, innovation and growth, especially in the OECD. The sector has historically been important to growth processes in most countries, and possesses several features that make it especially relevant for high productivity and high growth. Their scale of production can often be increased rapidly. They also enjoy economies of scale from increased specialisation, greater backward and forward linkages, greater possibilities for rapid technological change from international technology transfer, and more links to new and innovative technologies.

These characteristics have often provided the sector with a privileged status in national policy. At the same time, in poor

[64] Most studies of the Green Revolution that boosted the production and productivity of major crops in Asia identify the contributing factors as to including improved irrigation; improved and new seed and growing technology packages; and social and policy changes affecting ownership and tenancy, markets, credits and energy and transport infrastructure. The term "technology" often led people to focus on machines and hardware, and not recognize the software – people, skills, routines, social networking, and the role of organizations and institutions – integral to innovation in these areas.

countries the direct poverty reducing potential of increased productivity in agriculture and natural resources cannot be ignored. For Sida, it is important to avoid this binary division between the two sectors.

The Growth Commission cautions that any listing of all factors does not provide the set of *all of the necessary or sufficient conditions* for growth. They recommend an understanding of the dynamics: attention to the elements of the system "increase[s] the chances of accelerating growth" while, conversely, "persistent inattention" to the issues reduces the chances of success.[65]

3.4 TECHNOLOGY, INNOVATION SYSTEMS AND KNOWLEDGE

An innovation requires two different characteristics to be defined as such. The first is *novelty* (e.g. a new idea or knowledge, a new medicine, a new way of doing things, a new process or product). The second is its *use or implementation*. Innovation refers to *the use* of new ideas, new technologies, or new ways of doing things, which may be new to the world, a specific place or a people. There is a crucial distinction between "invention" (creation of new knowledge that could possibly be applied but is not always, which is normally the domain for research) and "innovation" (in the sense of use, in sufficient scale, beyond field experiments or demonstrations).[66] The emergence of the "innovation systems" concept is often tagged to the mid-1980s when, more or less independently of each other, several scholars, building upon earlier findings, started using the term "National Innovation Systems (NIS)" to explain differences in productivity

[65] Commission on Growth and Development, 2008 pp. 33–68, It lists a set of ingredients that emerge as important for promoting sustainable growth – high savings and investment, especially in infrastructure; a stable macro policy environment supporting stable exchange and inflation rates; an openness to foreign capital and investment, exports, competition and industrial policy; and, important for our purposes, the role of knowledge, technology, education and labour skills, equity and opportunities, regional development, avoiding known policy defects (or bad ideas) and the quality of the policy debate.

[66] Rath, Amitav, Science, Technology and Policy in the Periphery: A Perspective from the Centre, *World Development*, 1990, pp. 1429–1444. Again, here use does not mean a single prototype or at laboratory scale but at a larger scale and in day to day usage.

growth in OECD countries.[67] In our view the most important addition made by the NIS concept was to highlight the systemic nature of innovations, the fact that innovations take place within systems of interactions and incentives that influence both the capacity and willingness of firms (or organizations) and individuals to invest resources (time as well as money) in new (and hence inherently risky) ventures, methods and approaches. Empirical studies show that highly complex and interactive processes are involved with the emergence, adoption, use and diffusion of new technologies – or innovation – and these systems are nested and interconnected. In the 1990s, OECD, UNCTAD and other international organisations, as well as national governments began using these ideas as a framework for policy, and over time almost all countries have come to make some use of "innovation systems" concepts in policy.[68]

[67] Eklund, Magnus, *Adoption of the Innovation System Concept in Sweden*, Uppsala Studies in Economic History 81,Uppsala, 2007, states that Christopher Freeman used the term "national innovation system" once in an unpublished 1982 OECD paper, later published as Freeman (2004). In 1985 Bengt-Åke Lundvall made use of the innovation system concept in a research report on the interaction between users and producers, and so did many other researchers, influenced by Freeman and the work at Science and Technology Policy Research (SPRU). Eklund states the first widely published mention of "national innovation systems" took place in 1987 with Freeman's book on Technology Policy and Economic Performance of Japan, but also that it had been used by Vedin in 1982 in the domestic Swedish debate on innovation. Godin, Benoit, *Innovation: The History of a Category*, Project on the Intellectual History of Innovation, Working Paper No. 1, Montréal, Québec, 2008 refers to the intellectual roots of the innovation system concept with a group of people – Freeman, Nelson and Lundvall working on science and technology policy at OECD in the early days. This was then diffused through further research and teaching at a few pioneering centres such as SPRU. Beyond the work in the industrialized countries, research with systems perspectives on innovations and capacity building in developing countries became a primary focus at IDRC with Geoff Oldham. Among the evaluation team, Barnett, Rath and Sagasti belong to this Freeman, SPRU and IDRC network on innovations systems.

[68] There has been a rapid growth in literature on "innovation systems", with the OECD a focal point for many ideas. But also, outside the rich countries, there is increasing work and studies in Latin America and Asia, and in and about Africa. While the number of studies in and about OECD countries dwarves that from other regions, there is a sufficient core of knowledge currently available on innovations in poor countries that Sida can rely upon as it moves forward, and also, of course, as Sida helps to builds additional knowledge and capacity in and on poor countries.

In our view there are many alternatives to the NIS framework, if we drop the focus on the "national" as the most relevant system boundary. We believe that many other useful formulations of "innovation systems" operate within regions, cutting across nations. Many "innovation systems" operate on other specific value chains and sectors. The most important parts of the concept focus on the *systemic nature* of innovations. This is in contrast to seeing innovations only as a necessary output of research. According to Lundvall the concept of NIS provides "a synthesis of the most pertinent stylised facts produced by empirical research on innovation in the post war period" which allows for a more systematic attention to the socio-economic environment, and to how environmental variables can facilitate or obstruct innovation.[69,70]

3.5 KNOWLEDGE PRODUCTION AND THE TRIPLE HELIX

In the 1990s, a parallel wave of new research and writing incorporated many of the ideas of "innovation systems", but focused more on "knowledge" inputs and the producers of knowledge as a key factor in growth and innovation.[71] The new emphasis on knowledge was linked to the observed processes of changes brought about by globalization and to the new modes for the production and distribution of knowledge. The advances in information and communications technologies (ICTs) made knowledge more widely available, potentially making it more abundant and affordable.

It was also proposed that the mode of "knowledge production" has changed to a new Mode 2, where knowledge is created by

69 Lundvall, Bengt- Åke, *Notes on Innovation Systems and Economic Development*, Draft, October 2010, p. 36.

70 Following Lundvall, we believe the focus on the word "national", as well as the national level of policy, partly stems from the fact that the literature is more skewed towards OECD countries, which possess existing and relatively functional national systemic features that influence firms to invest in innovations, and with stronger national level systems that function as a coordination device for linking local levels to the global level. As we summarise later, in poor developing countries this is often not the case, with weak national levels of incentives that negatively affect innovation, simply because of the weakness of the state.

71 Jones, Nicola, Ajoy Datta and Harry Jones, *Knowledge, Policy and Power*, Overseas Development Institute, London, 2009, provides a good discussion on "knowledge", some definitions on page 4, followed by the role of actors, networks and innovation systems.

networks of researchers with different disciplinary backgrounds, working together, often temporarily, on problem-oriented applications. [72] Such knowledge is closely tied to the context in which it is produced and is diffused through network links rather than through published articles, increasing the importance of networks. It was also suggested that centres of knowledge were increasingly diffused because more people received scientific training, were dispersed throughout society and production entities, and were no longer centred at universities and research institutes alone. Another view was that producers or firms rely increasingly on knowledge inputs in an intensified competitive environment and can, in the right circumstances, rely on the knowledge production that takes place at universities as one important source for innovation. They are, therefore, themselves new nodes for knowledge.

Among the most relevant for this study is the work on Mode 2 knowledge generation that links innovations more closely with university research and more broadly with the research sector.[73] Sociologists Henry Etzkowitz and Loet Leydesdorff made the link between innovation and university with the concept of the 'Triple Helix', which characterised the relationship between universities, industry and government as a potential systemic relationship where the three actors become more interdependent (see glossary for further details). Sweden also searched for models to reform its research and innovation system throughout the 1990s. This resulted in the creation of the Swedish Governmental Agency for Innovation Systems (VINNOVA), the first creation by a government agency to

[72] Mode 1 is meant to incorporate disciplinary research and this has strict academic norms and is located within universities, research departments and laboratories. Mode 2 is trans-disciplinary, cross-organizational, within temporary networks, and hence evidences many potentials for conflicting understanding and goals, and increasingly across national borders, according to Gibbons, Michael, Camille Limoges, Helga Nowotny, Simon Schwartzman, Peter Scott and Martin Trow, *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, London: Sage, 1994.

[73] Gibbons, et. al. 1994. Eklund. 2007, states that the Gibbons study was initiated in the early 1990s by the Swedish Council for Research and Planning, responsible for coordinating the research councils and facilitating trans-disciplinary research. Mode 2 knowledge is context-driven, problem-focused and interdisciplinary, and involves multidisciplinary teams, often brought together for short periods of time to work on specific problems in the real world. Gibbons and his colleagues distinguished this from traditional research, called "Mode 1", which is academic, investigator-initiated and discipline-based knowledge.

support a national innovation system. Commentators have argued that this was a big leap that can be analysed as a strategic and rhetorical 'manipulation' of the concept by actors who wanted to defend sectoral/applied research and make university research more economically and socially relevant. Swedish research policy has always been characterised by two parallel and often colliding coalitions: research based on social and economic relevance versus the more pristine conception of universities as organisations pursuing human curiosity in relative isolation from the surrounding society. The supporters of research guided by social and economic relevance were successful in introducing the innovation system concept, with VINNOVA funding research for technical change. With this, most other research, including research motivated by sectoral needs, was funded through faculty grants or research councils, guided by representatives of the scientific community. A two-track system effectively exists in Sweden where national policy supporting basic research coexists with a policy-driven innovation research agenda. Eklund concludes that in the late 1990s innovations and academic research were increasingly viewed as interconnected, with new models being developed.[74]

Several important questions for poor countries emerge from these theories. One is that the new technologies, ICTs, network effects and other changes in the environment potentially reduce the portion of the global knowledge base accessible to researchers and users in poor countries. While they open up new opportunities, another is the nature of the appropriate policies for the (re-)organisation of knowledge-producing institutions and their management in the face of rapid technological changes and expansion of the private sector. They lead to questions about the steps required to ensure the improved flow of knowledge within and across countries and regions and the flow of knowledge and experiences between different types of actors within the "innovation system". We found that much of the thinking and policy experimentation on Triple Helix models as related to Mode 2 knowledge production has been in OECD countries, and so Section 3.9 provides a summary of the most relevant issues to guide Sida in working with poor countries.

[74] Eklund, 2007.

3.6 UNIVERSITIES: KNOWLEDGE AND INNOVATION SYSTEMS

Universities are important entities in national innovation systems, and they have a long history with well-established roles and traditions. They have traditionally served as a reservoir of knowledge in society, increasing the pool of people with key knowledge capacities and connecting the people with knowledge and artefacts deemed valuable at home and abroad. The primary function or mission of all universities is the provision of tertiary level training and the production of highly qualified personnel, graduates, researchers and other trainees. These individuals then directly utilise their new skills and knowledge in economic activities and also transfer and spin-off knowledge and research results.[75] A second mission of universities has been to undertake research for the production of new knowledge, to exchange knowledge and, equally or more importantly, to train researchers needed for the economy. In addition to teaching and research, the new so-called **third mission** focuses on more *direct* knowledge diffusion and technology transfer for social and economic benefits, as well as providing a potential new home for economic activities.[76]

The direct impact of university research on economic development is not entirely new. It has been used to promote agricultural productivity since the 1860's, beginning with the American "land-grant universities". Prasada Reddy provides additional examples in Brazil and Vietnam, where, as in many other countries, the knowledge inputs from universities to increased outputs, employment, and exports in

[75] In much of the discussion of the role of Universities, this first and universal role is often stated as their first mission. The second mission is to undertake research and advance knowledge. Finally, new and additional ways to serve society is labeled the third mission. For instance, see Göransson, Bo and Claes Brundenius (eds), *Universities in Transition: The Changing Role and Challenges for Academic Institutions*, Springer and International Development Research Centre, Ottawa, 2011; an output of this portfolio.

[76] OECD, National Innovation Systems, Paris, 1997, lists the potential direct outputs of the university within an innovation system to include: Venture business, Spin-off and technology transfer; the formation of a new enterprise, or licensing to an established firm, based on specific outputs of a research program; and Consulting contracts; collaborations with industry or government organizations, leading to new policy, culture, and communications through non-scholarly media. All are part of important outputs of the research and higher education system towards socio-economic value creation.

agriculture have been very important. [77] He points out that in many countries, university-industry collaborations have also been taking place for a long time in fields such as chemistry, medicine and engineering. They range from simple activities such as testing of machinery and materials to more complex technology development projects. Due to recent changes such as globalisation, new technologies and the increased value of skilled people and knowledge to the economy, and to the importance of networks, all discussed in the previous section, policymakers have determined that a new "third mission" of universities is to make a direct input to economic development. This has increased demands on academic institutions, which are attempting to adjust to the changing conditions. OECD countries have initiated policies and incentives to embed institutions of higher education and research more centrally in the national innovation system. The new policies include partnerships and alliances with firms; diffusion of technology use from the lab; co-operative research with industry; movement of personnel between academia and firms; and academics, researchers and even the educational organisations themselves undertaking entrepreneurial activities.[78] These steps increasingly co-locate knowledge, skilled people and production, with educational institutions transforming themselves into "entrepreneurial universities".[79]

It is increasingly accepted that there is a potentially larger role for the higher education system as a source of learning and capability development, and that "this role has often been neglected, in favour of other 'quick fixes'. The gains of science and technology policy – as well as of innovation policy more broadly – "are long term rather than short term, diffused rather than concentrated and visible." [80] But there are no blueprints outlining what is the right balance or how to achieve it, as the goals and balance will be different for countries and for institutions within countries.

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77 Reddy, Prasada, The Evolving Role of Universities in Economic Development: The Case of University–Industry Linkages, in Göransson, Bo and Claes Brundenius (eds), 2011, pp. 25–49.

78 The measure for communication of knowledge is often limited to the counting of written reports and research papers. But that is often less useful, as it neglects tacit knowledge. A very effective path for this tacit knowledge flow is the movement of people.

79 It needs to be noted here, that this trend is not without critics, who argue against the university's direct participation in industrial innovation and fear potential negative impacts on knowledge generation and welfare due to the stifling of free enquiry, among other reasons.

80 Göransson and Brundenius (eds), 2011, p. 5.

The university is itself a large and complex system. It can also be conceived of as one unit within multiple HE organizations or subsystems, both within the larger "national innovation system" and global systems. It is a component of "higher education" or "research systems", and is one important constituent, in all countries, of learning, capacity-building and knowledge systems. It often links with other national, regional and global knowledge systems. All universities must work within the various systemic levels of interactions and incentives to balance their three functions. In many countries, especially poor countries, there has been a rapid rise in the training provided by the tertiary sector over the past two decades, with declining per capita student budgets. Universities must also provide links to the world knowledge system – an intelligence and reservoir function – that can then be exploited by other sectors. This requires some minimum of attention to research capacity, networks and outputs. Yet, resources and capacity for research have been especially weak in many of the countries in this portfolio. Resource constraints in poor countries make for difficult choices in appropriate sequence and prioritisation between the "three missions" for many universities.

3.7 CLUSTERS INITIATIVES

While these new ideas about innovation systems, knowledge and education gained currency, new theories of regional development evolved in parallel. New paradigms suggested a tool for regional policy, innovation and development. The theories were based on the observation that dense, closely connected and interacting networks – consisting of people, firms, skills, infrastructure and knowledge – can form powerful nodes for innovation and competitiveness, leading to economic growth. The Triple Helix concept provides a systemic framework in which the key actors work together, intermingling the use and production of knowledge, and in which regions provide new locations for innovation and economic growth.[81]

[81] See Angeles Diez, Maria and Maria Soledad Esteban, *The evaluation of regional innovation and cluster policies: looking for n*ew approaches, University of the Basque Country, presented at Fourth EES Conference, Lausanne, October 12–14, 2000, and Richard Florida, Towards the learning region, *Futures*, Vol. 27, No. 5 , pp. 527–536, 1995., is a major contributor to some of the new ideas of regional learning networks. The idea of promoting regional competitiveness, and the concept of industrial clusters, were also studied by Porter as part of his work on the competitive advantages of firms. See Porter, Michael, (1990) The Competitive Advantage of Nations, New York, Basic Books, 1990.

Several reviews, first in the European Union (EU) and then in other OECD countries, have pointed to the increasing popularity of cluster strategies as an important economic development approach. However, a recent review paper found that as yet "many policymakers and practitioners have only a limited understanding of what clusters are and how to build economic development strategies around them."[82] Cluster-based development projects, or cluster initiatives (CI), became a more widespread tool for economic development within the EU from the mid-1990s on.

In the past ten years there have also been a number of CIs in developing and transition countries. They have been largely donor-led initiatives, but more focused on firm competitiveness and less on linkages to knowledge systems, as in this portfolio. CIs focus on learning, building on strengths, and going beyond analysis to engagement with cluster members. Research on and analysis of clusters is only one tool, and a starting point in CI. On-going dialogue with economic actors in the cluster must take place in order to achieve change and real impact. The study of 260 clusters initiatives around the world revealed that as many as 85 per cent of cluster initiatives were rated as having increased the competitiveness of cluster firms.[83]

The four cluster projects in Bolivia, Mozambique, Tanzania and Uganda that have been implemented in the Sida Portfolio all followed the generic model of Triple Helix (illustrated below). They share a similar aim with the Nicaraguan program to increase cooperation between universities and firms and develop an innovative environment. The difference in the approach in Nicaragua is the greater focus on capacities within and between a group of universities (discussed earlier) to enable universities to improve upon their third mission (input in economic development) and play a stronger role in this more direct translation of knowledge into application. Figure 3 shows the evolution of CI as per the theory.

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[82] Cortright, Joseph, *Making Sense of Clusters: Regional Competitiveness and Economic Development*, The Brookings Institution, Washington D.C, 2006. The report suggested that one difficulty of translation to policy makers has been due to the explosion of new research on the subject.

[83] Sölvell, Örjan, Christian Ketels and Göran Lindqvist, *The Cluster Initiative Greenbook,* The Competitiveness Institute (TCI), Stockholm, September, 2003. They have reported on a survey with data from 450 CIs that completed a Global Cluster Initiative Survey in 2003 and the remaining statements are from this report.

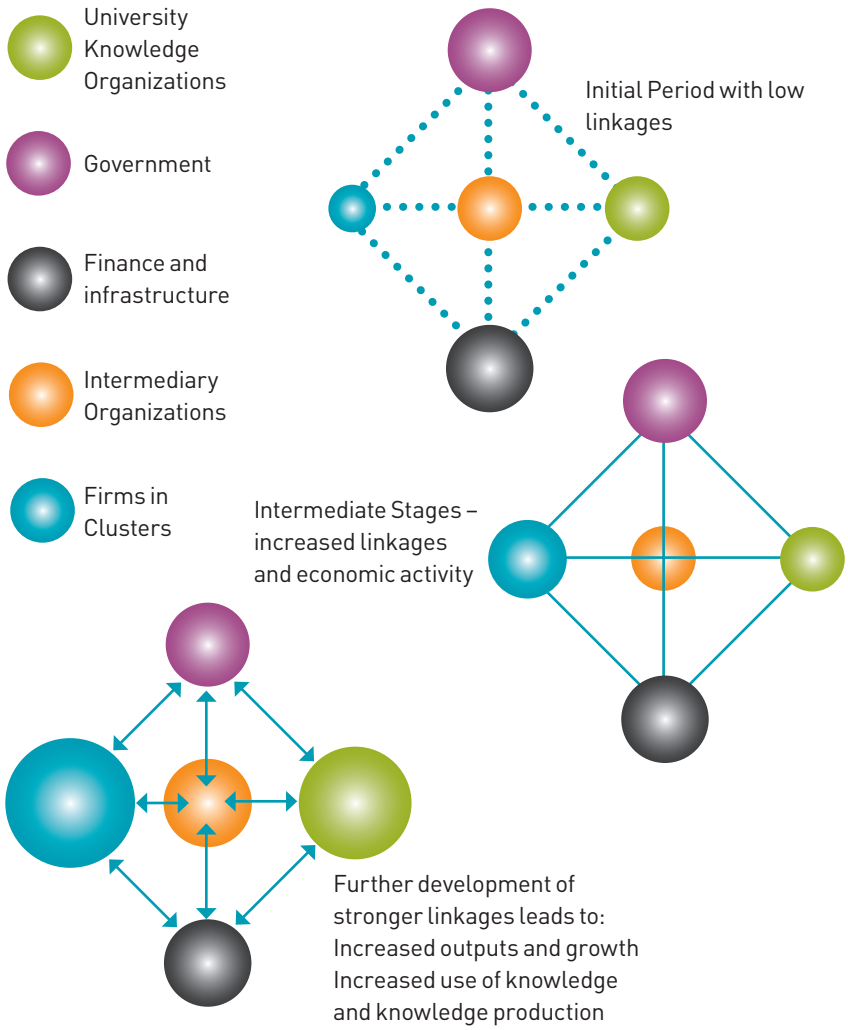

Figure 3: Evolution of Interactions and Outcomes in CI

3.8 SUMMARY OF IS FOR SIDA USE IN POOR COUNTRIES

The overall theory on innovations systems and clusters and what is known from empirical work as it pertains to poorer countries is summarized here, as requested in the ToR. The ideas associated with systems of innovation as they apply to developing countries are well

summarized by Arnold and Bell.[84] Schematically, an Innovation System includes all key private, public, academic and civil society entities involved in the creation, dissemination and utilization of knowledge and technology, their relationships and interactions, institutional structures, incentives and rules, and their roles in the production of goods and provision of services. Even in poor countries, there is an increase in the variety and number of actors involved in the innovation process.

All systemic representations point to the importance of both the "supply push" of new knowledge from the research community and the "demand pull" from the users of new knowledge, as key features of innovation systems. Hence, successful innovations require constant interaction between the different organisations and actors. It also suggests the need for systematic processes to understand the "demand", not only from poor end users, but also from other actors in the system such as equipment manufacturers and suppliers, product and service retailers, the financial institutions, government, and so on.

The theory highlights the importance of networks, coalitions and partnerships across organisations, both formal and informal. Links that help foster trust and lower transaction costs of the interactions are important. Trust relations improve knowledge of each other's needs and capacities as well as the nature and quality of the goods and services on offer. Networks and trust relationships lead to "clustering" and CI attempts to increase such trust among members to

[84] See Arnold, Eric and Martin Bell, *Some New Ideas About Research for Development*, in Danish Ministry of Foreign Affairs: Partnership at the Leading Edge: A Danish Vision for Knowledge, Research and Development, pp. 278–316, 2001. They provide a simplified diagram of the major elements of the linkages required in a successful innovation system with similarities to the cluster diagram (see Figure 4). It should be noted that this diagram does not include the international dimension which is very relevant to the discussion for Sida, but Rath, 1990, provides another systems representation that pays greater attention to the fact of the linkages between national and international systems of innovation. For more recent updates see for instance Szogs, Astrid, Andrew Cummings and Cristina Chaminade, *Building systems of innovation in less developed countries: The role of intermediate organizations*. CIRCLE, Lund, 2008. Other useful sources are Sagasti, Francisco, *Knowledge and Innovation for Development*, Cheltenham, Edward Elgar Publishers, 2004, and Sagasti, Francisco, Ciencia. Tecnología. Innovación. Políticas para América Latina, Lima/México, Fondo de Cultura Económica, 2011, in Spanish.

increase cooperation.[85] Network capacity can be more important for successful innovation than the capacity of individual researchers or organisations. An innovations systems approach highlights many other "systemic" issues such as the framework or policy environment, the importance of "tacit" knowledge, and the need for systems diagnosis to improve the performance of the innovation system. Systems perform only as well as the weakest constituent element, and strengthening one element inordinately does not improve system behaviour, as other barriers provide the operating constraints.[86]

Experience shows that "working with and reworking the stock of knowledge is the dominant activity in innovation." Innovation requires constant interactions and effective communication between suppliers and users. Innovations highlight the importance of networks, coalitions, and partnerships across organizations and channels. Basic ideas that emerge include a need for "systems thinking", the definition of appropriate systems, and knowledge of their interactions, in order to promote successful innovations. Therefore, programs must work with a range of actors at multiple levels, have flexible linkages, and use interventions that are balanced, flexible and iterative. Programs must have an understanding of partners, together with their institutional rules and incentive frameworks. Greater understanding requires greater use of participatory processes. The integration of knowledge across multiple dimensions is critical and requires more active coordination efforts. The coordination needs can easily be misconstrued as high "administration and overhead costs".

Linking knowledge institutions to firms is not easy. Bell also notes that many studies find that firms tend to draw on knowledge inputs first from other firms for their innovative activities.[87] Only later, as

[85] See Schmitz, Hubert (ed) with Khalid Nadvi, *Industrial Clusters in Developing Countries*, Special Issue, World Development, 1990; on the role of trust on actors in the same location for certain types of innovation such as Silicon valley in California, the Cambridge Science Park, and the instrument cluster in Sialkot, Pakistan.

[86] These two paragraphs have been extracted from Rath, Amitav and Andrew Barnett, *Innovations Systems: Concepts, Approaches and Lessons from RNRRS*, The Policy Practice Limited, RNRRS Innovation Synthesis Study No. 10, 3 January 2006.

[87] "Firms and enterprises are not simply users of innovations produced by other actors in the system", but they create a large proportion of the knowledge they needed, and they acquired most of the remaining proportion from other firms, not from central and public institutes. Bell, Martin. (2009) *Innovation Capabilities and Directions of Development*, STEPS Working Paper 33, Brighton: STEPS Centre, University of Sussex, 2009, p. 28.

they deepen their own innovative capabilities to include design and technology development, do they begin to interact in significant ways with research organisations. The reason for this appears to be that economic actors need to build up some internal capacity as well as motivation to absorb Research and Development-derived knowledge from external sources. Thus, it is not easy for public Research and Development organisations to link to innovation in industry. This is even more difficult in poorer countries: the poorer the conditions, the weaker the links within a "system of innovation". This does not mean that going from research to application is not possible, but it requires greater efforts and more detailed understanding about the linkages that need to take place. It is now well-recognized that innovations systems ideas cannot be simply "bolted on" to research initiatives. Unfortunately, there are no simple recipes to achieve systemic improvements. At the same time, it is our view that, while the innovation systems concepts provide for a richer understanding of the factors – their interplay and sometimes useful prescriptions – often they do not provide for easy policy prescriptions. More research and experimentation is certainly required with regard to desirable public policies that aim to promote innovation as well as the effects of such policies in poor countries. Too often researchers and writings on innovation systems have a narrow focus on competitiveness and neglect the detrimental effects of technology development, which need to be kept in mind everywhere, but more so in poor countries.

In spite of the smaller amount of research on small and poor developing countries, there is a growing body of work from and about these countries.[88] Some important facts to keep in mind for Sida are:

1. It is important to note that, in many poor countries, a large portion of all productive activities are based on traditional and indigenous knowledge, competencies and skills. Unfortunately, most coexist with little interaction with the more modern part of the economy and are not sufficient on their own for social and economic development. Integration of traditional and local knowledge and improved utilization of local natural resources provide useful and possible starting points for innovations in poor countries. Existing practices can be made more productive with the

[88] Kraemer-Mbula, Erika and Watu Wamae (eds), *Innovation and the Development Agenda*, OECD and IDRC, Ottawa, 2010; provides a good discussion of innovation issues in poor countries in Chapters 3 and 4.

addition and integration of modern knowledge and research focused on improving upon local technology and production.[89] This link is important to development. A key challenge in poor countries is to establish mechanisms and interactions to promote knowledge flows within and between traditional and modern knowledge systems.

2. Compared to external markets, local products, processes, and unmet demands from local buyers allow for more immediate and cost effective innovative solutions. Although these can include and incorporate "modern" processes such as metal work, often enterprises are using out-dated technologies. Thus, there is an opportunity to apply new knowledge inputs to the economy (keeping in mind the specific conditions of size, cost, etc.).
3. The NIS in poor countries has to be more receptive to links with the outside world. These links carry potentials for both negative and positive outcomes, and increasing positive links and reducing negative outcomes is a major role for Sida and is an area that merits further study.
4. It is generally recognized that firms are often more open to interactions with other firms rather than universities and research institutions, and sometimes even more so to foreign firms when buying new technology or learning new methods.[90]
5. Innovations in the context of poor countries will most often mean "local or minor innovations", or innovations that are only first applied in that country or region. The adaptation of technologies to use local inputs, the introduction of small changes in production procedures to improve efficiency, reverse engineering and copying technologies, and the increased productivity in use of natural resources, are common types of "minor" innovative activities. Such innovations may often not seem exciting, as they are not at the world's innovation or research frontiers, but are crucial for positive poverty and growth impacts.

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[89] Kuramoto, Juana and Francisco Sagasti. "Integrating Local and Global Knowledge, Technology and Production Systems: Challenges for Technical Cooperation", in *Science, Technology and Society, Special Issue on Innovation Context and Strategy for Scientific Research in Latin America,* Vol. 7, No. 2, 2002, pp. 215–248.

[90] For instance, Bell, 2009, p. 28, notes – "Firms create a large proportion of the knowledge they need, and they acquire the remaining proportion from other firms, and not from public institutes. So, firms are often both knowledge-producers and knowledge-users and they interact mainly with other firms".

6. While the bulk of technological capabilities are acquired within production entities, government agencies, academic units and civil society organizations play an important role in promoting innovations. Government action is critical and irreplaceable and innovation systems in poor countries are more dependent on public policy. This is because of the "public good" character of knowledge and also because the demand side is weaker, the firms are weaker, the system is more fragmented, and the capacity of local firms to pick and choose from the global system is weaker.
7. The role of civil society for promoting innovations is not yet well understood, but is likely to be more important in poor countries. Many grassroots organizations have resisted certain innovations, especially Genetically Modified Organisms (GMO), or promoted other innovations such as water conservation. Finally, there are new issues related to growth that have to be taken into account when considering innovations, for instance the kinds of "greener" growth that are more sustainable with regards to challenges such as climate change. Perhaps the world needs to think more about green growth. But these issues are significantly more complex, and we do not as yet understand them well globally. There is certainly a large need, both in poor and less poor countries, to increase research for generating global knowledge towards what factors can contribute to more sustainable growth.

4 Findings

This chapter presents the main findings of the evaluation. The first section discusses the following: the conceptualisation of innovation used by FORSK in working with the portfolios of projects; Sida's views and use of the innovation concept across the broader organization; the potential usefulness of the frameworks used by FORSK; and some activities of other donors in the field of research and innovation and on the Triple Helix and CI concepts. The next section presents an analysis of how the innovation system concepts worked within the portfolio of projects. The analysis starts at the case level, with a brief summary of relevant results for each intervention, and follows this up with findings that concern the portfolio as a whole. Attention is paid to project planning, monitoring, evaluation, and the cross-cutting issue of gender. Finally, the chapter presents a summary of the key success factors and challenges, concluding with a discussion of the usefulness of the Triple Helix, CI and the IS frameworks for FORSK and Sida.

4.1 CONCEPTS USED

4.1.1 Sida – Research Cooperation

For the five contributions at the national level, Sida used the Triple Helix model of innovations that prioritised universities and the VINNOVA model for CI as the way of working. Sida defined the concept of innovation as the use of ideas, technologies, or ways of doing things that are new to a specific context. It could be said that it used the theory of change, which states that:

"Innovations require interaction between researchers, industry and political bodies, effective communications, and networks and partnerships across organizations and channels. Universities are able to offer education, training, research and advisory services; they are a potentially powerful vehicle for development, particularly with respect to science and technology. Yet, in many low-income countries, links between university and society may still be weak. Even if such links exist, they need to be systematically organized in order to stimulate cooperation. Local and national development could be

accelerated if both universities and industry were encouraged to work actively together and if universities would assume an "entrepreneurial" role. Clustering is a proactive process to accelerate local economic growth. It means firms and other stakeholders within a concentrated geographical area cooperating towards common goals and establishing close linkages and working alliances to improve their collective competitiveness." [91,92]

[91] Lindroos, Maija and Tomas Kjellqvist, *Information & Assessment MEMO,* 5 December 2006 for Nicaragua, Sida, SAREC, 2006. This document recommends support to IUP-Nicaragua and provides a discussion of three ISCP initiatives in Eastern Africa. This is the only time that a Sida document discusses the five country interventions as forming a new initiative. This memo combines the ideas of Triple Helix/CI that were followed in four countries, including bringing in additional "stakeholders" as required. Emphasis was placed on the different organizations "working together". The Alänge and Scheinberg, 2005 report, which preceded IUP Nicaragua, also uses the same Triple Helix/CI models, but had added that there was a need for explicit inclusion of additional stakeholders in the context of the Latin American countries. In the activities of IUP Nicaragua, Chalmers team stated that they had not used the Triple Helix as a way of working, but had instead used the 'Stakeholder approach'. Hence in Nicaragua, the project did not involve Triple Helix/CI type activities. The evaluation could find no formal definitions of the "stakeholder" approach used. We agree that the theory states that innovations require a multi stakeholder approach but that alone does not provide a sufficient guide to actions. What can be agreed to here is that five country initiatives share in their definitions of innovation and underlying theory of change. But Nicaragua represented a different "way of working" compared to the other four. While, Triple Helix/CI focuses on four groups of actors/stakeholders, and is led by the needs of the productive sector; in Nicaragua, the "stake holder approach" focused on the University sector only, while encouraging, building capacities and abilities at the universities to coordinate and interact with the other stakeholders. Both Sida and Chalmers believe the Nicaragua represents a fundamentally different "way at working with innovation" for Sida, and this view is respected in the narrative and the Table that follows.

[92] At the Management Group meeting the point was made that the above definition and use of the word innovation mentions mainly its role for growth. It was suggested and was accepted for the report that the relevance of innovation systems to other important concerns such as health, education and natural resources and environment should be mentioned, however briefly (this is above and beyond their contributions to growth and examples encompass innovations such as bed nets, water catchments for arid regions, and so on). The role of additional actors such as civil society, workers, media and new communications technology also required a mention. This was added in Chapter 2, the theoretical overview.

A discussion of the concept of innovation systems could be found only once (above) in the documentation produced by FORSK.[93] The Sida statements were in accordance with the theory discussed in Chapter Three. It correctly emphasized "minor" or incremental innovations and the framework allowed for increased links between components, processes and actors that are relevant to research and innovation, as suggested in the 2006 review. Sida anticipated that the "entrepreneurial" role in "clustering" could accelerate local economic growth. Sida found in the Triple Helix/CI model the principal ideas about innovations and knowledge. Hence the Triple Helix/CI model provided one principal core for the evaluation. The schematic diagram given previously on Triple Helix/CI (Figure 3: Evolution of Interactions and Outcomes in CI) summarises the theory, while the Figure 4, summarises the expected outputs and outcomes by stakeholders.

Beyond the work supported in the countries under Triple Helix/CI, which were to different degrees and manner types of "action learning" research, Sida also consciously took advantage of opportunities to mobilize researchers to look more deeply at the issues of research, higher education, innovation, and their roles in developing countries. Specifically, they allowed developing country researchers to participate in international networks through conferences such as Globelics and research studies such as UNIDEV. They also supported a "Forum on Higher Education and Research" located at UNESCO and a policy research network in Africa. The importance of these for the portfolio are not in the modes employed – networks for social and policy research – a well-established mode with relatively well known benefits and costs, but in the nature of the new "knowledge and capacity" outputs and outcomes.

In BIO-EARN, which began in 1997 and focused on training researchers, Sida added new elements of support over time – for "technology development", technology transfer and policy changes – to enable the use of the increased research capacity for social and economic value. This relevance of this idea finds support in the

[93] Lindroos and Kjellqvist, 2006. The document mentions the 2006 assessment of Sida research recommendation, discussed in section 3.2, as a primary reason to extend its contributions towards strengthening the links between university, research and the productive sector. The above statement has guided the evaluation in the study of the activities, outputs and outcomes of the portfolio. In a number of cases it was found that most of these ideas were not reflected consistently in project designs in the portfolio studied.

theory of innovation and growth: *new science, technology and knowledge developed through areas such as biotechnologies provide opportunities for the region to develop their own versions of "science-led economic growth"* [94] and can assist in developing a stronger economy utilizing natural resources.[95]

The innovation systems theory suggests many other possible entry points for innovation (some are discussed below). The modes employed make sense for research cooperation as a natural extension of research capacity building. FORSK made an experiment to support a portfolio of innovation-related contributions within its overall support. We find that the ideas of innovation systems and clusters have provided the research Unit a conceptual tool that enabled it to combine its role in promoting capacity development in research and knowledge with its role in supporting the goal of Swedish development assistance – improving *conditions for sustainable economic growth processes in poor developing countries* – with greater impact. We examine later the nature and extent of additional impacts.

4.1.2 Sida – other activities

We believe that other parts of Sida have used these concepts, particularly in the health, agriculture and natural resource sectors, but not with any consistency. We found only three other Sida documents that discussed and used the concept of innovation systems.[96]

The first area was in the health sector, where support for many global initiatives to promote innovations in both poor and rich countries for improved health is now well accepted. [97] The Sida document focuses on creating incentives for the pharmaceutical industry in

[94] The emphasis made in the proposal document, for a "science led economic growth", which we have discussed is actually narrower than the innovation theory suggests.

[95] It will be seen later that the largest investment in the portfolio used some of the ideas of innovation systems and some of the same words poorly. The documents did not in fact provide for good discussions or understanding of how the ideas should influence the choice of activities, the project design and resource allocations. The design remained firmly located in the older and somewhat inadequate, linear model of research. BIO-EARN consistently followed the logic that the research would be followed by "innovations". The case is discussed more fully in the parallel volume on each case.

[96] Our inability to find other instances does not of course imply that other documents making use of innovation systems concepts do not exist. But they do suggest that Sida as a whole has not used these ideas consistently or widely.

[97] Ahlén, Jonas, Peter Lundström and Josephine Rudebeck, *Innovative Finance for Health – Exploring Incentives for Neglected Disease R&D*, Sida, September 2009.

Sweden to provide innovations relevant to poor countries (e.g. new drugs and vaccines that address neglected diseases). It discussed "innovative financing" where by public investment in R&D could be increased by leveraging additional private sector investment. Conceptually more important is the potential use of public sector funds as a guarantor of market demand, and the point made that applications require much larger allocation of funds than the research and discovery phase. But the document has a very clear linear model for research to application, where the issue is largely seen as increasing the supply and direction of research towards the desired ends.

On the other hand, the review of the uses of mobile phones points out that technological advancement, together with investments and regulations have made the mobile phone a major innovation for communications in Africa.[98] It then enabled many new uses (innovations) by economic actors and is continuing to provide a platform for further innovations in mobile banking and money transfer, health and agriculture. The review of innovations in mobile applications does not actually refer to or use "innovation systems" ideas directly, but they are embedded in the recommendation that, "to encourage economic growth and social development" the interplay between reduced costs, appliance innovation and applications need to be strengthened, while each element is itself further developed. It again highlights the fact that interactions are driven by different stakeholders, and adds that on-going innovations require long-term funding and commitment from both market actors and funding agencies.

In the agriculture, natural resources and environment sectors, significant efforts involve the promotion of innovations, but in these sectors researchers often use different words and sometimes emphasize different issues. Many projects in agriculture have classic innovation objectives such as developing new seeds, new farming practices, new inputs, processes and new products. Such programs very often have an objective to support and integrate "indigenous" and local knowledge with new forms of scientific knowledge, and they explicitly promote local innovations. In agriculture the idea of "extension" services that link together research and knowledge with producers has been well established for over a hundred years, but there have been many critiques of the seemingly linear concept of extension services, viewed as a top down process where knowledge

[98] Hellström, Johan, *The Innovative Use of Mobile Applications in East Africa,* Sida Review No. 2010:12, Sida, 2010.

flows take place only from researchers to farmers. Good practice and recent theories emphasize the increased involvement of farmers in the innovation system, and innovation systems ideas are often well entrenched in these programs.

Among several well-known innovation models, the "Farmer Field Schools", developed in the Philippines, the 'Farmer First' (FF) model out of IDS, Sussex and the models of the Wageningen School are examples of three newer innovation centric models. They emphasize many features of IS ideas, including the importance of user perspectives and engagement for innovation outcomes in agricultural research and development. Farmer First highlights the great complexity of knowledge and innovation systems, management systems and the politics of agricultural research and development, and calls for a broad systems view that considers global and local markets and value chains. The Wageningen School emphasizes social learning, interaction, institutions, cognition and knowledge. Innovations result from the interplay of different actors; "social capital" is key to effective innovation systems. It points out that communication between actors is not simple and is often insufficient without active engagement. Essentially, this reframing of innovations in agriculture and natural resources emphasizes similar issues to those in the other literature covered. However, the various traditions often run in parallel and do not always use the same words or suggest identical priorities, even when they have identical objectives.[99]

An example would be Mozambique, where Sida along with other partners supports the PROAGRI initiative. It aims to promote institutional development together with agricultural research, extension services, and improved production in agriculture and livestock, together with improved management of land, forests and wildlife. Here innovations are explicitly stated to be an aim, and the programme also supports activities whose implicit aim is to promote innovations. Most donors, including Sida, also support NGOs to promote innovations in and for rural areas for water conservation, clean water provision, health, and so on. Again, the different sectors here do not usually use the same language because much of the

[99] See Jones, Harry, Nicola Jones, Dannie Romney and Daniel Walden. Conceptual review on innovation systems approaches and their use in understanding pro-poor innovation in the renewable natural resources sector. *Report for the Impact Evaluation Component of the Research Into Use (RIU) Programme*, (DFID), Overseas Development Institute and CABI, January 2009; for an useful overview of some these traditions on innovations.

"innovations systems" literature as defined by OECD has a manufacturing origin and focus, with the private firm as the main, and sometimes the only, locus for innovations.

The proposed Business for Development (B4D) program announcement utilises ideas and concepts from innovation systems.[100] The key elements in the B4D Toolbox are: Challenge Funds, Public Private Partnerships, Innovative Financing, Market Transformation, Innovations Against Poverty, and Social Entrepreneurship. They are similar to the concepts that have been covered earlier, both in terms of theory and the work of Sida. The concepts within the B4D program have more in common with other donor programs in their focus on productive sector development, mainly in the private sector. B4D does not yet focus on cluster concepts, which could be easily incorporated (see other donor programs).

We find that some of the theory and many of the practises in agriculture, natural resources and environment in Sida use similar concepts, and many of the ideas discussed here would be familiar to those sectors. What is relatively distinct to the five country projects in the portfolio is their emphasis on the higher education sector as the focus and the central node for coordinating innovation inputs. Also their focus on the anticipated impacts on both higher education and on economic actors is new. Other departments within Sida do not appear to be involved in research cooperation work with either innovation systems/clusters or the specific emphasis on universities.

The programs supported by Sida can, with relative ease, incorporate innovation system concepts in agriculture and natural resources, health, education and the business/private sector, beyond the current and expanded usage by the research sector. In a few discussions, Sida staff stated that the higher education sector in Sida was interested in learning from and applying the systems approaches, including the lessons from the innovation systems and clusters programming. The most direct result of the study that applies to future options for the higher education sector and to education overall is the value of practical learning through engagement with productive activities, with mutual benefits for both the learners and producers. Value was also found in engagement with social development. The issues of integration within Sida would need to be studied further within an organizational context to determine the barriers to cross fertilization of ideas and to innovations in work processes.

[100] Brochure of the announcement for Sida *Business for Development – B4D*, April 2010.

4.1.3 Other donor agencies

Innovation seems to be everywhere – "in social sciences like history, sociology, management and economics, and in the humanities and arts. Innovation is also a central idea in the popular imaginary, in the media, in public policy and is part of everybody's vocabulary.... a panacea for resolving many problems." [101] It would be surprising, therefore, if other donor agencies did not make use of the same concepts of innovation systems that are of potential relevance to Sida. Given how ubiquitous the concepts are, a review of the ways in which other agencies use them must be brief and confined to several key Sida partners. Among the research funding agencies, there remains an uneven but visibly growing interest and engagement with the ideas of innovation and research in innovation in or for poor countries.[102]

The International Development Research Centre (IDRC), a long-term partner with Sida in the area of research support, has "Innovating for Development" as its strategic framework. It recently added the words *ideas, innovation, and impact* as descriptive of its work. It has one program, "Innovation, Technology and Society (ITS)", that supports research in the area of innovations.[103] It partnered with Sida in the UNIDEV project, one of the constituents of the current portfolio, and is a co-publisher of the book *Universities in Transition: The Changing Role and Challenges for Academic Institutions*. This was an output of the project.[104]

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[101] Godin, Benoît, 2008.

[102] The June 2011 informal meeting of the research donors, IFORD, included discussions of innovation systems ideas as used by some of the agencies.

[103] The program aims to generate research outputs that strengthens the institutional and learning capacity of developing country innovation systems, to improve the understanding, capacity and linkages of innovation system actors (organizations and individuals) in developing countries; support the development of S&T policies that contribute to improved functioning of developing country innovation systems; and strengthen impact analysis, social inclusion and learning capabilities in support of innovation and the governance of new technologies. The IDRC program on Innovation, Technology and Society has been undergoing an external review of achievements and challenges in 2010; see *Program on Innovation, Technology and Society*, interim documents, 2010. http://www.idrc.ca/cp/ev-159932-201-1-DO_TOPIC.html.

[104] A reason for the long involvement of IDRC on some of the issues covered in this study is that the act of Parliament that governs IDRC, defined "Research" to include any inquiry, or experiment, carried out either to discover new knowledge or *to apply existing knowledge* to the solution of economic and social problems.

Among the larger bilateral research support organizations, the Department for International Development, U.K. (DFID) has engaged extensively with the issue of innovations and the use of its research.[105] A primary aim of DFID's work has been to increase the "demand/pull" for research, so that it has more relevance.[106] DFID is also currently undertaking a very large research program, "The Research into Use", in agriculture and natural resources that explicitly examines the demand for research and its uptake.[107] It has focused on enabling research users to take part in setting the research agenda, while recognising that different stakeholders have different capabilities to effectively articulate demand.[108] Some of the good practices that DFID intends to pursue are: to actively improve

[105] DFID states in *Research Strategy, Working Paper Series: Stimulating Demand for Research, April 2008*, the plans to spend up to £1 billion on research between 2008 and 2013. DFID's Research Strategy describes how it aims to provide for maximum impact on reducing poverty in developing countries.

[106] DFID, 2005.

[107] Two members of the current evaluation team undertook some studies and provided advice to the program. See Barnett, Andrew, *Innovation Policy: Lessons from the Department for International Development's Crop Post Harvest Research Programme*, Partnerships for Innovation, Policy Practise, 2005; Barnett, Andrew, *Journeying from Research to Innovation: Lessons from the Department for International Development's Crop Post Harvest Research Programme*, Partnerships for Innovation, Policy Practice, 2006; and, Rath, Amitav Andrew Barnett, 2006. *Innovation Systems, Concepts, Approaches and Lessons from RNRRS,* RNRSS Synthesis Study Number 10, January 2006; at http://www.thepolicypractice.com/papersdetails.asp?code=1

[108] In consultations many pointed out that demand is not easy to determine, there is a need to worry about "demand failure" by the public sector; and enquiries within countries would need to be conducted very carefully to avoid getting stock, "expected" answers. For instance the UK The National Coordinating Centre for National Health Service Delivery and Organisation R&D Programme uses two methods to prioritise research to strike a balance between two modes of knowledge production: in mode one, the main objective is to produce new knowledge, which builds on a stock of prior discipline-based, peer reviewed research. In mode two, the main objective is to develop problem solving capabilities in a society at large. Researchers said demand is neither necessary nor sufficient for good research, some may have no user-orientation, while others such as vaccine research can be both fundamental and user-oriented but not have market demand, as complications to any simple view. Research was "rarely a demand-driven activity as such", but rather required "the building of expertise and capacity among different stakeholder groups to identify, prioritise, facilitate and then direct nationally or regionally relevant agendas for research".

processes for priority-setting by stakeholders and research users; and to move from the earlier linear approach where research is followed by action to one that promotes an innovation systems approach. DFID is convinced that it is not only important to establish the impact of research, but also to invest resources to enable the actual and potential users of research to articulate their needs and develop the capacity to use research-based knowledge for the benefit of poor people.

On the other hand, a recent evaluation of the research supported by the Swiss Development Cooperation (SDC) said that their work was not based on a clear conceptual framework that linked research to the strategic goals of SDC. They also indicated a belief by senior staff that there had been insufficient application of research results. The evaluation found that the linkages between research and development were not made explicit, and urged SDC to establish clearer and more explicit 'models of change' for research that explain how "inputs of research investment are translated into outcomes through intermediate processes." It stated that SDC does not give sufficient attention to the broader systems of innovation, has a tendency to assume that investment in research will necessarily generate development outcomes, and "downplay[s] the importance of the wider range of interventions required to create the right context and incentives for innovation to occur and to be sustained." SDC also needed to "consider how it might work more effectively with the private sector in developing countries in order to stimulate research and innovation." [109]

Two other international partners, the World Bank and USAID, do not easily provide for a brief narrative of their involvement in innovation systems and clusters. But they do have several activities that are noteworthy for Sida. The World Bank has several departments and units (International Trade, Finance, and Private Sector Development) and thematic areas (e.g. export Competitiveness) that refer to science, technology and cluster initiatives. The World Bank Institute has several learning programs that include a "Skills & Innovation Policy" to support policies for a "Knowledge

[109] Evaluation of SDC's Research Related Activities, March 2010; available at http://www.deza.admin.ch/en/Home/Activities/Evaluation/Completed_evaluations/2010, based on evaluation done by Andrew Barnett, Gareth Williams, Anna Khakee and John Young, 20 January, 2010.

Economy", and it also has a group working on Science, Technology and Innovation.[110] USAID was a major funder of cluster initiatives in the late 1990s, and remained involved at least until 2008.[111] During that period, it supported a large number of cluster initiatives and two useful review exercises of these CIs.

The OECD remains a focal point for many ideas, research and data on innovation systems, and naturally its focus is mainly on the issues most relevant to its member countries. From time to time the OECD has expanded its horizons to look at issues of non-members and poor countries, most recently as a component of a new strategy initiated in 2007 to work on innovations as a means of addressing global challenges.[112] UNESCO and UNIDO have done some work and studies on poor countries. The prevalence of the idea of innovation systems in international development means that almost all multilateral agencies have some involvement in this area. In recent years, work in Latin America and Asia, and increasingly in and about Africa, has grown steadily due to increased policy and research interest. All these can provide Sida with additional insights and partners.

To summarize: given that innovation is everywhere, it is not surprising that many, if not all, agencies use at least some of the same words and concepts regarding innovations, which are of potential relevance to Sida. Only a small number are discussed above. While

[110] The World Bank held a Global Forum on Innovation and Capacity Building for Sustainable Development in December 2009.

[111] Cogan Wares, Amy with Stephen J. Hadley, *The cluster approach to economic development*, Technical Brief No. 7, USAID/EGAT/EG Contract No.: EEM-C-00-06-00022-00, September 2008. The document states the peak of the approach at USAID was in 2003, when there were projects in 26 countries totaling $60 million with most projects in the Europe and Eurasia. It concludes that "it is difficult to quantify the impact of these cluster projects since many benefits of clusters result from spillover effects", and "few project evaluations have been done and there is a surprising lack of baseline data" (p. 9). Yet, USAID commissioned two stock-taking exercises to better understand cluster initiatives in developing countries that found that cluster projects usually have long time horizons, and there is also great variation in the approach and structure of cluster development projects, making generalizations very difficult. Cluster initiatives in advanced countries typically emphasized promoting innovation and supporting research and development, while that was rarely a primary goal for developing/transition countries.

[112] A useful recent publication is by Kraemer-Mbula, Erika and Watu Wamae (eds), *Innovation and the Development Agenda*, OECD/IDRC, 2010. This resulted from a workshop in January 2009, sponsored by OECD with the UNESCO Forum on Higher Education supported by Sida.

the use of the words 'innovation' and 'systems' has become ubiquitous in the discourse of funding agencies and development literature, it is often used without precision, and the presence of these words in a document or plan does not necessarily imply a focus on the same issues.

Many of the ideas behind "innovation systems" came from research on technical/technological change in manufacturing. There are other parallel traditions focused on links between research and users that promote research use or innovation, for example in the design of agricultural research, and its extension and diffusion, for several decades.[113] Some of the work that has been supported in the Triple Helix/CI projects in our portfolio, such as growing mushrooms, new seeds and seaweed, have a natural resource base. They have many commonalities with similar activities by governments, donors, agencies and NGOs, where projects are designed to increase incomes or production in the natural resource and environment sectors. It will be useful for Sida, as it promotes and expands on the use of the ideas from innovation systems, to work with internal and external partners and stakeholders to increase the clarity and understanding of the key framework and ideas, so that cooperation can be more effective.

4.2 WORKING WITH THE PORTFOLIO

FORSK worked with innovation systems and Triple Helix/CI initiatives on a pilot and experimental basis. It moved in a cautious and incremental fashion, with a focus on increasing the use of knowledge resources and improving economic and social outcomes. In late 2003, closer contacts with VINNOVA sparked Sida to invite small delegations from Tanzania, Uganda and Mozambique to attend a meeting on clusters, which over time became the universe of this study as ISCP – EA. In 2004, Sida supported a team from the Latin American region – Bolivia, Honduras and Nicaragua – to attend another conference on innovative clusters in Ottawa. A team of researchers from Chalmers University of Technology assisted them. This led to IUP- Nicaragua and the clusters project in Bolivia. Sida played a catalytic role in developing each country programme.

[113] Even though the words used were not often the same as more modern usage.

Sida also ensured that the initiatives remained "demand-led", in that core groups and individuals were convinced of the potential value of the pilots from their participation at knowledge networks and preparatory activities that were funded by Sida. Keeping these in mind meant that it took over three years before the pilot programmes of cluster initiatives began. We found the slow speed appropriate as it helped ensure local ownership. Sida started each support with smaller pilot and exploratory grants from its regional and global programs and then increased the funding as results appeared promising. Slowly the funding was merged into the larger bilateral country funding programmes as appropriate.

But these efforts were insufficient to ensure success in all cases, as in the intervention in Mozambique where weaker local structures, identical project design and lack of flexibility in the face of administration difficulties resulted in low outcomes. Another challenge has been the tension between (a) being demand-led and ensuring ownership, and (b) ensuring that partners demand what Sida has on offer. Thus, in Nicaragua, the planning phase was for a programme based on the Triple Helix/CI model, but ultimately the local counterparts underemphasized some of the elements of Triple Helix/CI and focused more on building capacity across the university partners, one component of the system. In all countries, the initiative has remained only very partially integrated with other University activities, including those funded by Sida.

In 2005, Sida took another complementary step and began to provide support to five organizations for policy research on innovations, the development of innovative environments, and the fostering of relationships between university and society. The results were expected to contribute to the knowledge and understanding of mechanisms and avenues for enhancing interaction between universities, firms and policy makers. Three of these are a part of the universe of this evaluation – the UNIDEV project coordinated by the Research Policy Institute (RPI), Lund University, and the partnership of Chalmers University of Technology with Nicaragua. The third complementary and related effort was to support the annual Globelics conferences. The conference theme was innovation and development, and the goal was to increase research, knowledge,

capacity and use of knowledge to foster change in developing countries.[114]

BIO-EARN, however, was initiated in 1997 and predated this thinking. It represents a more standard research capacity building project in which Sida has had considerable past success, specifically supporting sandwich[115] PhD programs in cooperation with Swedish institutions. Evaluations and reviews starting from 2003/2004 mentioned positive results for capacity building, but expressed concerns about the use and application of the capacity. In the 2006 approval document, Sida stated that there was a shift in the focus from capacity building to "research for use", and added new elements to the design, including an "Innovation Fund". The review found that this activity remained isolated from the thinking on innovation systems and the only one with no links to others in the portfolio. The evidence suggests an inability within Sida to transfer the knowledge and experience of people working in one part of the portfolio to those working in other parts of it.

4.3 SIDA PURPOSE AND HYPOTHESES

All the supported Triple Helix/CI projects used the concept of innovation as the use of ideas, technologies, or ways of doing things that are new to a specific context. This as we have said, is a more relevant definition for small and poor countries, where innovation, as defined in the developed world, is less relevant. No definitions and hypotheses were consistently articulated in the approval documents in the

[114] The other two policy research networks are the African Technology Policy Study located in Nairobi, and the "Forum on Higher Education and Research" located at UNESCO. Each of one of them faced challenges that are discussed in two evaluations. The first network's challenge related to management and governance, while the second faced challenges in its efforts to bring together natural science, education and social science, to undertake joint support and work together. In each case, Sida correctly in our view, closed the support when the key stakeholders were unable to take corrective actions to improve efficiency and effectiveness. For more detailed reviews see Rath, Amitav and Rasigan Maharajh, Kathryn Touré, and Moses Mbangwana, with Christopher Smart and Onguéné Essono, *An External Evaluation: The African Technology Policy Studies Network* (Revised Main Technical Report), August 2008 at http://www.idrc.ca/uploads/user-S/12266048981ATPS_Main_Report_Final_Oct_31.pdf; and Rath, Amitav and Mario Bazán, Erika Kraemer-Mbula, Geoff Oldham, Fernando Prada, Francisco Sagasti, 2010. Evaluation of UNESCO's Strategic Programme Objective 4: Fostering Policies and Capacity-Building in Science, Technology and Innovation, Internal Oversight Service, Evaluation Section, UNESCO, Paris, IOS/EVS/PI/103March 2010.

[115] Explained in the Glossary.

other initiatives. Within the five national projects, the key hypothesis was that innovations required interactions between stakeholders; they also required effective communications, networks and partnerships across knowledge domains, organizations and channels. Initial analysis showed that these links were often weak or non-existent and so needed to be developed, organized and sustained.

The Sida hypotheses included the view that the capacity of universities and the knowledge sector is under-utilised, a corollary to the poor links mentioned above. All of these ideas are well-supported in both the theory and the observations from both industrialized and developing countries. Following from these facts and surmises, Sida made the further hypothesis that the Triple Helix/CI theories and practice provide a potentially good model for reducing the under-utilization of the capacity for socio-economic gains. This is at the core of the five national projects focused on Universities.

Excellent discussions on these facets are provided in the UNIDEV outputs and by the research that Sida supports through the network on Higher Education and Research at UNESCO. It is our view that there are many roles for universities to play in this context, and the fundamental contribution of these roles to development is not sufficiently highlighted in many donor programmes. This is likely due to the facts that they seem difficult to characterise and measure, and often the range of impacts are not available within the short time frame in which outcomes and impacts are normally measured. It is up to Sida, given its long and successful role in building such capacity, to further highlight the benefits stemming from the core functions of universities. As such, these are beyond the scope of this report. More focused studies are needed that can demonstrate the many ways in which universities are already powerful vehicles for economic development through the delivery of their traditional missions of training and research capacity building, and how they further contribute through their links to global knowledge systems. It will also be important to examine the challenges and difficulties that they face in the rapidly evolving contexts for poor countries.

It should be noted that, in its short summary of the Innovation System ideas within Triple Helix/CI, Sida did not elaborate on potential additional outcomes beyond new products. The theory also discusses the importance of social learning and increased social capital, which can be important inputs for development. Sida did note that the interactions between different institutions, actors and knowledge domains are a more complex process requiring more active

coordination. It did not highlight, nor make operational, a fundamental premise behind IS that communications and understanding between the different actors is inefficient without active engagement, and that engagement in a common endeavour is key to building social capital. Finally, Sida did not elaborate on the important IS idea that the process of engagement, when it leads to successful innovation outcomes, enhances understanding of user needs by all actors, including researchers. Thus, over time, the vector of research, capacity building and knowledge outputs would be shifted towards more *useful* outputs, leading to positive feedback loops, which is one of the most powerful ideas in the IS literature. Figure 4 uses a similar framework to Figure 3 to show the expected orientation and types of outcomes across the actors involved in the Triple Helix/CI initiative space.

We conclude that these ideas provided Sida's research Unit with a useful conceptual tool with which to promote capacity development in research and knowledge that supports the goal of Swedish development assistance to improve *conditions for sustainable economic growth processes in poor developing countries, and achieve greater impact.*

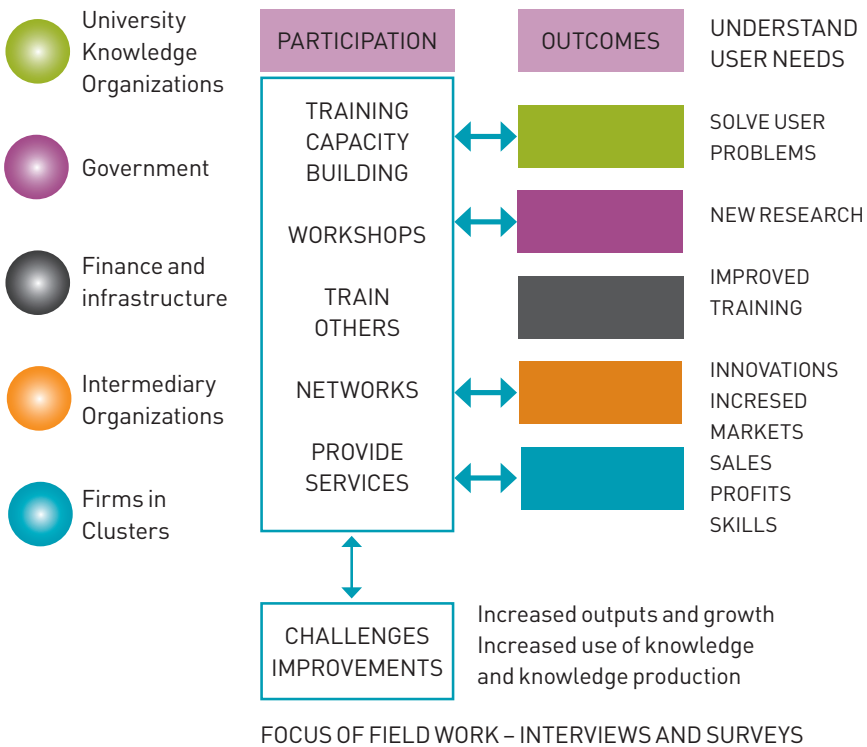

Figure 4: Outcomes Space by Actors in Triple Helix/Cluster Initiatives

4.4 RESULTS – THE PORTFOLIO AND ITS ELEMENTS

The results from the projects in Tanzania, Uganda and Bolivia show that many of the hypotheses of the Triple Helix/CI hold up very well. The results are highly positive on the four main types of outcomes that Sida hoped to see. Results relating to the impacts on the research climate and agendas of the universities are mixed. The BIO-EARN project, on the other hand, succeeded in delivering the traditional outputs and outcomes but did not achieve new product/process outcomes and economic impacts as planned because the concepts used remained firmly rooted in the traditional "linear view" of research to use.

The highlights of the results are presented below, disaggregated by the 10 case studies for the portfolio of grants.[116] The table below summarises a number of them, building upon tables 1 and 2 in Chapter 2. Knowledge and capacity building outputs are common across all interventions in the portfolio. But there are also significant differences between the initiatives within the portfolio on how outputs of knowledge and capacity were generated, and the mechanisms used. These differences lead to differences in the types of knowledge emphasized within an intervention and the sets of individuals and organisations whose knowledge and capacity was built.

[116] Full details and the basis for the statements are available in case study volume. The 10 case studies and the 7 surveys are together very lengthy, but they provide more detailed information on each intervention and the findings related to each. Many readers, especially the stakeholders engaged in a specific intervention, will be interested more in the details of the project in which they have been involved and would find more information there. Another reason for making available the detailed cases, together with the data and methods used in each case, is to allow individuals to draw additional or even alternate conclusions. This is in keeping with good practice.

Table 3: Summary of Portfolio results

Table 3a: Summary of Four Cluster Initiatives

Case	Results: Outputs and Outcomes	Main Limitations	Noteworthy and/or Positive Factors
1. ISCP – Mozambique 2. ISCP – Tanzania 3. ISCP – Uganda 4. Bolivia	Many reports; networks built across knowledge, policy, production and infrastructure domains. Improved information on production, markets and technology. Produced CI coordinators. Improved human resources. Knowledge generated; transferred. Better understanding of problems and arriving at new solutions. University – expansion of pool of skilled human resources. Engagement to local problem solving and better research outputs. Government- improved engagement in local problem solving, policy, knowledge and support. Economic growth – increased outputs, efficiency, social capital, jobs, incomes and revenues.	Could have been improved in the activities though greater involvement of students and wider inclusion of knowledge capacities at the universities. Management of national activities of varying quality between countries in spite of efforts at coordination. Cluster initiatives of varying quality and outcome by clusters – natural and to be expected to a larger degree. Improved actions were possible based on analysis, and learning from portfolio of CI and "Triple Helix" partners. Weakness in M&E focused on learning about individual clusters, total impacts, and rigidity of design. The degree of involvement of researchers and faculties, by numbers and their knowledge base varied across the four cases. Greater impacts were seen with higher involvement of faculty and students, and also of schools and departments within the university. Too often the involvement was limited to science and engineering and student involvement was low.	Very high positive outcomes compared to the cost of the initiatives. Suggests the possibilities for new designs that can scale up these initiatives. Increased and improved courses, graduates and other trainees, research for problem solving – more limited impacts. Increased knowledge transferred, of quality and relevance for producers is noteworthy and second is the fairly rapid impacts efficiency and effectiveness of interventions for economic growth and use of knowledge at the production level through improved policy and support services and innovations that increased outputs, efficiency, jobs, incomes, productivity. Many additional features are possible in a new range of Sida and national interventions. There is a considerable potential to expand on all achievements. Experiences are of very high value to Sida support for research cooperation, especially bilateral initiatives, and also for some of the other sectors for Sida support.

Table 3b: Summary of Innovative University: Nicaragua

Case	Results: Outputs and Outcomes	Main Limitations	Noteworthy and/or Positive Factors
5. IUP – Nicaragua	Large numbers of activities and outputs as defined in the design – commitment of the universities, specifications of goals and priorities for research and innovation, need analysis of customers, new practices, strategic alliances made within and without, IP processes and implementation, diffusion. New knowledge created, policy changes at Universities and CNU, some improved courses, graduates and other trainees, research and problem solving.	Strong M&E focused on three monthly reports. Weak coverage of outcomes beyond the activities planned and their schedule. Low focus on additional stakeholders beyond universities, and to increased knowledge transfer, quality and relevance, understanding of user problems and arriving at new solutions. Outcomes on improved knowledge transfer and economic impacts need further follow up at later time.	A systems perspectives does not negate a design that focuses on one element of the system – the universities. Even a systems perspective can rely on a single intervention to strengthen a weak element in the system. The ideas behind this intervention can be highly relevant to Sida support to HE institutions as one required intervention to increase internal capacity, which is seen to be a bottleneck across all projects in the portfolio.

Table 3c: Networks

Case	Results: Outputs and Outcomes	Main Limitations	Noteworthy and/or Positive Factors
6&7. UNIDEV Globelics	Both of them had meetings and workshops as activities, that improved research and knowledge exchange. UNIDEV focused on Universities role in innovation and development. Globelics had a wider canvass on innovation systems and included training for PhD. Both followed up on ideas and questions, in a network. Outputs and outcomes include improved knowledge of innovation systems and development. Greater capacity for research and policy on innovation systems in developing countries. Dissemination of research findings. Wider pool of resources and human capacity through training by new researchers.	The innovations systems theory and work on the use of policy research, confirms the difficulty of achieving the larger social outcomes that the researchers had placed before themselves. The close contacts among the network members provided the benefits of high quality research outputs it is likely that it also shut out policy makers and firms as they were not a part of the same network. Sida could have been more pro active in making use of the knowledge generated at forums. Sida should see itself as a "partner" and "network member" that should assist beyond the provision of finances, to assist in the dissemination of results and the process of change in partner countries. But Sida is limited by its staff and process constraints from playing a more active and participative role.	Greater application of knowledge for policy making to promote innovations is noted but is an indirect outcome in that those whose capacity was increased then relied on their own organizations, additional local and policy networks to apply new capacity to improve development outcomes. The use and application outcomes are outside the project boundaries compared to the first group but that does not necessarily mean poorer outcomes but does require different methods to capture. The organizers and Sida should consider in any future development would be whether additional pointers from the innovation models could be adopted to make this set of activities even more effective?

Case	Results: Outputs and Outcomes	Main Limitations	Noteworthy and/or Positive Factors
8. PACF	This is an outcome of ISCP. PACF successfully completed the planned outputs of three training programs for cluster facilitators, two for Nigeria and Gambia; and, one for Ghana and Senegal in 2010, but the first activity initiated in Kenya could not be followed up due to a lack of interest from local partners.	Absence of data, to state with evidence, the success or lack there of for PACF. Plans do not acknowledge challenges of implementation that show up from the three country experiences.	The success of the cluster initiatives require a number of inputs to be provided simultaneously, with a high need for locally coordinated actions and management. These are inherently difficult for a pan Africa organization to provide. On the other hand the goal of PACF to provide a platform for knowledge sharing and expansion of the knowledge base on clusters and cluster based development initiatives in Africa" is a lower cost and lower risk endeavour, highly relevant and deserves support.

Table 3d: BIO-EARN and Bio-Innovate

Case	Results: Outputs and Outcomes	Main Limitations	Noteworthy and/or Positive Factors
9. BIO-EARN	The achievements noted include – large numbers of trained people, number of scientific publications, capacities and competences improved for research using biotechnology. Multiplication of capacity building through new training, new research grants; improved regional & international collaboration of 35 institutions, new curricula developed in molecular biology, biotechnology and bio-informatics, at four organizations. Research infrastructure built in 17 laboratories in the region with two having attracted additional funding support. Using biosciences to improve local breeding of planting material. Involvement of policy makers;this facilitated the development of biotechnology policies. It uses one idea from innovation systems literature well – that "use" requires constant interchange between actors. Thus considerable resources were provided for activities for collaboration and information sharing, with policy makers, and supported by the experience of SEI, the efforts proved effective in developing policy capacity in biotechnology and biosafety and is one important outcomes.	The documents reviewed state that outcomes and impacts from the use of research products for economic purposes are low and yet to be achieved. The always anticipated additional support by regional governments, donors and foundations, did not materialize. A major challenge has been to meeting the goals of greater "local ownership" and improving management efficiency in the institutions in the region. There is little discussion of challenges and what steps were taken to resolve them. There is no acknowledgement of trade offs between goals, such as efficiency and ownership; research versus application; requirements for "transparency", and the creation of the required "trust" by stakeholders. Use of words and concepts of "Innovation" and how to promote it, with great imprecision, often research and innovation are used interchangeably. The concept is firmly rooted in the "linear view" of research leading to applications and use. Among flaws in the design is a lack of awareness of the difficulties in improving research management skills, university level administrative bottlenecks, procurement at participating institutions, and challenges in linking to the weak local private sector and faster withdrawal of support by Swedish partners than was appropriate.	Full analysis has not been possible. This one program lasted over a decade and with investments over SEK 177 million, is larger than all the other cases put together in the portfolio. Given the newness of the field in the countries involved, the time required to impact in terms of new products and process may be longer than assumed. It is possible that the interventions are appropriate and direct economic impacts will only be seen at the end of Bio-Innovate Phase II (2013 to 2016). There are more diffuse impacts from training of new people, and the work done in firms and in other organisations, where they contribute to increased production, productivity or safety, all innovations that may not be captured. New products processes are not the only way to contribute to the economy. Impacts are also seen on the second mission of the University to increase knowledge production through research, and provide improved access to the global knowledge base.

Case	Results: Outputs and Outcomes	Main Limitations	Noteworthy and/or Positive Factors
10. Bio-Innovate	To a large degree builds on the infrastructure capacity, experiences and achievements made in the BIO-EARN. It has some stated differences – research fund with competitive research grants; more user-, market- and development oriented; greater focus on inter-disciplinarity; new structure to solve "ownership" issues; more effective program management, a stronger M&E focus on communicating lessons and experiences. Also two new countries added – Burundi and Rwanda; and a new theme of climate change added. It had been operating for only about six months, no outputs and outcomes expected at time of evaluation.	We conclude the similarities between BIO-EARN and Bio-Innovate are larger than the differences, with same focus and similar activities but with climate change and 2 new countries as added areas of concern. Tinkering around the edges on the rules, without clarity on their intended effects, could lead to the unintended outcomes. Applying a simple test of indicators for the use of IS concepts, we find that most of concepts were poorly understood, or not provided for in the design and resource allocation in the previous project, and given the continuities, together with added complexities in the new Bio-Innovate design, there is a cause for concern on likely effectiveness at achieving stated outcomes. Risks identified and mitigated needs additional work including the examination of stakeholder capacities and challenges. Improved understanding and mitigation of risks would lead to modifications to the program design so as to reduce risks. A likely result would be to reallocate resources from research to improving coordination, stakeholder engagement and additional capacities. Larger involvement of additional partners, including Swedish, is likely to be beneficial.	This is a very interesting project that addresses the real needs of the group of countries to catch up in this new area of technology. The literature confirms that applications of biotechnology can provide a very significant potential for economic but it is a more complex undertaking than assumed in the documents reviewed. Given the large investments, Sida must urgently consider additional steps that could strengthen the program and increase the probabilities of the desired goals being achieved. First there must be additional studies, with sufficient depth and scope with considerable stakeholder involvement, to better understand and then draw lessons from the past experiences of BIO-EARN, together with the regional and local context for Bio-Innovate to achieve its goals. The same study or another linked activity should include support for developing the M&E framework emphasized in the proposal, and ensure that such a framework moves beyond a checklist to include both indicators and a set of "practice" that allows all stakeholders to work towards the larger systemic goals.

Results from the projects in Tanzania, Uganda and Bolivia show that many of the hypotheses of the Triple Helix/CI hold up very well. The results are highly positive on the four main types of outcomes that Sida hoped to see. The Nicaraguan program, however, was different. It was established within the same theoretical framework, but was preceded by an extensive study of the preconditions and the barriers specific to Nicaragua. Given that there was a National Council of Universities that aimed to improve the engagement of the member universities in innovation, the initiative had more of a focus on universities and their role. The evaluation rates this effort as highly successful in working with a group of ten universities and coordinating bodies, but it did not involve CI. It cannot be judged whether this was a design defect or an entirely appropriate decision at the time.[117] All that can be said now is that, given the relative success of the cluster ideas in the other countries, cluster initiatives should be tried in Nicaragua.

The results from the two social science and policy study networks are narrower in their outcomes, as would be expected. At the same time, it must be noted that their outputs enrich the understanding and conceptual frameworks on IS and the roles and limitations of Universities. This is one of the complementary sets of outputs that Sida expected from the portfolio. Some of the findings that enrich our understanding of IS and the role of Universities as seen by the network participants, are captured in the survey and are available in the volume on individual cases.

On the other hand, the limited review confirms that when the concepts of IS were poorly understood and applied as in BIO-EARN, improved research capacity did not lead to innovations. Among the flaws in the design that are noted is a lack of awareness of the systemic weaknesses within and between the stakeholders involved. For greater effectiveness at achieving the stated innovation outcomes, changes in the design are suggested by

[117] On the other hand, the Nicaragua project had some good achievements at the University level, such as the design of an intellectual property policy, in building links and networks, and for technological services provided for improved quality. The project was able to include entrepreneurship and innovation as new issues in three academic programs. These achievements were reached through the innovation network, the experience gained, and the training provided in the project. And in Nicaragua additional examples of outcomes include policy directives such as the National Plan of Science, Technology and Innovation, the proposal for a law for Science, Technology and Innovation.

the theory and from experiences with IS, which include greater attention to diagnostic studies, and improved coordination and monitoring for the learning and engagement required by different actors across several domains.

4.5 HYPOTHESES AGAINST RESULTS

A few key examples of how the results matched or did not match with the hypotheses are provided below, starting with those made by Sida (there are others which are not listed):

Table 4: Sida hypotheses and findings

	Hypothesis	Results Observed	Comments
1	Innovation in poor countries will most often mean "local innovations", first applied locally and followed by wider use.	Almost all innovations observed were local. Some were national-level improvements, but most were sub-regional, cluster or firm specific innovations.	Observations from many of the successful CI initiatives. These are most relevant and growth promoting.
2	Innovations required interactions, effective communications, networks and partnerships between key actors.	This was seen most positively in the case of the four CI. Innovation in terms of "policy development" showed the same features in BIO-EARN.	Where the knowledge using sectors were not intimately involved from the beginning outcomes did NOT include direct use in the short term. The longer term "indirect" impacts can often be important and need different methods for observation.

	Hypothesis	Results Observed	Comments
3	In many low-income countries, the links between key actors in the innovation system are weak, and need to be systematically attended to and organized in order to stimulate cooperation.	Many interviews with all stakeholders confirmed this as a fact. The "idea that there exists relevant research and solid research capabilities within universities, but the private sector have little knowledge of the type of services that universities can provide, was very common when explaining the weak linkages between universities, industries and other actors." Analysis points to the lack of incentives to improve the pertinence of universities' research. In almost all cases in the portfolio, the participants commented on their additional learning and economic impacts were observed when increased links were emphasized.	One central finding for both innovation theory and many studies in both industrialized and developing countries is the difficulties with increasing weak links.
4	Sida said that universities are a potentially powerful vehicle for development, particularly with respect to knowledge, science and technology.	The longer term "indirect" impacts are not a part of this study, and are likely to be much larger than those studied here. Hence, new studies exploring these effects should be undertaken by Sida. The economic value of the direct use of a small subset of knowledge in the universities to support small and micro entrepreneurs through the Triple Helix model was a striking result of this study. The difficulties of making additional and greater direct use of modern science and technology to develop products and processes in poor countries was also illustrated in all countries, and this requires additional review and possible new strategies.	It is important to distinguish between the different functions of the university and the direct and indirect, more diffuse impacts. If that is not done, core functions of training and human capacity building can be neglected for more fashionable ideas. The difficulties of making greater direct use of more modern science and technology to develop products and processes in poor countries should NOT suggest that this is hopeless but that new designs with additional resources for the local context are required.

To summarize, it was confirmed that in poor countries many productivity-enhancing activities will most often comprise "local innovations", that is, they emerge first in local application and followed by wider use in the region or country. This is not as prestigious as innovations that are generated for the first time in the world, such as the first introduction of electricity or the internet for instance. But the local innovations that allow its use in new countries and for new applications, are crucial for positive poverty and growth impacts. Often innovations that are first in the world are less relevant at that time for growth and poverty. Sometimes there are also a number of innovations with high relevance to poor countries that are close to world frontiers. Mobile communications are one example of rapidly diffusing technology with widespread positive impacts in poor countries. New seeds (e.g. the NERICA rice in Africa) and low cost generic drugs for HIV/AIDS are examples of outcomes of local research efforts that, complemented by international links, are both first in the world and have high impacts.

The findings show that this hypothesis on use of research knowledge needs to be divided into two sub-statements. First, it is correct that there is a gap between the basic knowledge that is available in the education system versus what is available to many entrepreneurs and poor producers. The results support the Sida view that *universities are able to offer education, training, research and advisory services that can be growth promoting.* This was observed for all service offerings except that this was the least significant for the research dimension of outputs. Additional work is required to understand possible interventions that can increase the use of research. This will require building stronger links between users and research than existed in any of the interventions. It will likely require additional resources directed at the weakest links in the system. These weak links cannot be prejudged and are likely to vary for issues, sectors and countries.

The hypothesis, confirmed across the portfolio, that innovations required interactions between researchers, industry and political bodies, effective communications, networks and partnerships across organizations and channels, is almost a tautology in the innovation systems literature. These links are often weak and need to be systematically organized in order to stimulate cooperation; weak links are practically a symptomatic feature of poverty. The most important corollary of these two facts is the need to add support for increased links and interactions across system actors and to strengthen weak system elements in many interventions.

On the positive side, the core hypothesis that increased links and interactions could be crucial for development is illustrated in all the project interventions. In the four countries with CIs, the increased links and interactions ranged across the widest group of socio-economic actors – universities, firms, governments and other supporting institutions. Except in Mozambique, where the initiative was largely stalled due to challenges of implementation, they all indicate highly positive (though non-uniform) results on the actors along various development dimensions. They often include statements such as: cluster members have improved the quality of their products, which they can now sell in some shops and supermarkets; sales of products have increased; and cluster members have become aware of the services they can get from the university.[118] We find that the results confirm that the new innovation system and cluster theories as used by Sida, provide a good framework for linking education, research and use that can enhance growth and poverty reduction. No one single and exclusive model or "way of working" is best for all circumstances, and some single interventions could use multiple methods in a complementary manner. There should be flexibility in the strategies supported to meet Sida's high-level goals.

4.6 ADDITIONAL HYPOTHESES AND FINDINGS

Given that Sida has used and defined the concepts of innovation in a limited fashion, it is not surprising that the literature review pointed towards additional important dimensions. Many were listed in section 3.6. In this section we review two additional dimensions drawn from the literature review, specifically (a) building trust and social capital and (b) on different kinds of learning.[119]

A consistent finding across all TH/CI activities, and an early outcome in many initiatives, was improved trust and increased social capital among the different stakeholders in the projects, an outcome repeatedly cited. To quote one respondent, "Through ISCP, I was able to make the members and firms in my cluster initiative to work together, something that was not there before." In interviews conducted in certain clusters, such as metal workers, the respondents

[118] Taken from the survey reported in the volume on individual cases, p. 22; and from multiple interviews in the clusters, including seaweed, furniture, textiles, metal work and others.

[119] Many others are covered in the detailed discussions in the case study volume.

often provided examples of never having worked together before but often the newfound cooperation and trust allowed them to increase specialization in narrower functions and thereby increase productivity.

A number of very poor women provided examples of how they began to work together through the CI. Having established cooperative relations, they began taking larger orders and distributing them among themselves, something that they had not done earlier. Another respondent said a lesson learned was that, "Cooperation of related firms in a cluster has a higher chance of raising productivity and specialization than firms working in isolation, increasing revenue and [creating] a win-win situation for all stakeholders." A respondent from Uganda made the point from a more individual perspective: "I have now really learned that working alone as an individual is really hard to progress in a business setting." This building of trust and social capital was valuable in itself, and as a necessary precondition for the further success of the cluster.

The evaluation findings supported a key set of hypotheses from the theory about the distinction between codified and tacit knowledge that can be acquired from books and printed materials, and "learning by doing" that is acquired through actions, experience and social learning. Many respondents made pertinent and detailed observations about what promotes and hampers social learning. They noted that the training received by the facilitators was important and that the practice of working with the firms further improved the facilitators' capacities. There were also many suggestions on how to create improvements in the training and how involvement with the project allowed for more holistic learning. The participants often commented on their new capacity to conduct participatory and results-oriented programmes. They indicated having learned to build synergies in the process of solving entrepreneurs' business-related problems and challenges. They very often mentioned their "exposure to new ideas which could have been difficult to acquire" otherwise. They often commented on learning having arisen from the engagement and exposure to "practical problems faced in business," and gaining "experience in solving cross-cutting business problems." Another aspect mentioned was the learning about very different problems and issues across the value chain (e.g. from the seed supply to the farmer, the storage, transport, the miller and finally the flour sold by the shopkeeper).

4.7 OTHER SIDA QUESTIONS

Sida asked how contextually sensitive the different methods were that formed the portfolio and whether there were critical issues or phases. Clearly, the initial planning and capacity building is crucial, even though we are drawing lessons from a small sample. All CI projects incorporated long periods of careful planning and, together with all the other interventions in the portfolio, included continuous activities for building the capacity of the stakeholders. It was also important to have a sufficient and minimal number of already capable people with the right sets of motives and reasons, as well as institutional support and the necessary finances. The minimum number that appears necessary to catalyse the process in a relatively large organization, such as a university department, can only be estimated from our sample, but appears to require at least a dozen persons who are trained, motivated, have the requisite capacity and resources, and agree to work together.[120]

Results relating to the impacts on the research climate and agendas of the universities are mixed. The findings generally report increased learning about practical business problems by faculty and students with examples such as – getting involved in the IUP-Nicaragua project, helped to better understand the needs and solve the problems of end users, cluster members and firms. People often said they "started to understand new concepts and methodologies," "learned new tools for interpretation of users' needs and translated them to projects and programs," started to "help researchers to do a better analysis and interpretation of data," and "started to worked directly with users in their production areas with their enhanced capacity." Many commented positively on their individual learning experiences and a majority surveyed felt that the project really helped improve the capacity of universities to collaborate or initiate problem solving/R&D projects, increased cooperation within university, and increased cooperation between professors.

It is our view that the impacts of investments in higher education are likely to materialize many years after the intervention, but there are other factors worth considering. Our tentative, hypothesis is that over a longer period of time the type, nature and use of research will change in positive ways, but with two limitations. First, not all research at the university will be focused only on the issues raised by

[120] This very rough estimate is taken from the observations in the five national interventions.

the user needs, nor should it be. Second, the relatively low impacts on teaching and research at universities has partly been because of the small scale of the activities, the limited numbers and low involvement of individuals and departments and the lack of integration between these interventions and others supported by Sida. This area requires further study.

Interest from other international research funders on the CI projects has also been fairly limited, but that is most likely because the results of these interventions are not yet well known. Finally, while we did not find widespread interest in general from donors, there has been considerable national support in Uganda and increased interest from national authorities in Tanzania, as they became aware of the positive potential and the results of the programs. All the programs relate well to national/regional policies with regard to research, innovation, industry, and poverty reduction. The CI program activities impacted policy debate and formulation in all countries in which they operated. This is also true for the project in Nicaragua and the biotechnology initiative. But none of them have attracted additional donor support as yet. On the other hand, the two network research projects had more indirect impacts but still attracted support from other donors in the regions.

Sida had asked how issues of intellectual property rights (IPR)[121] had been dealt with in the portfolio. In a number of clusters, such as the new food products, sea weed products and others, new trademarks provided for an incentive mechanism for the producers to consistently provide higher quality products and to enhance the business reputation of cluster products. Patents are generally used to protect new and useful inventions, and here "newness" is defined as an inventive step that includes knowledge that is not obvious to one skilled in the field. As noted (Table 4) almost all innovations observed in the cluster initiatives were only locally new, with most consisting of cluster or firm specific innovations, where patents are

[121] The World Intellectual Property Organization (WIPO), a specialized agency of the United Nations, was established by a convention in 1967 with a mandate to promote the protection of Intellectual property (IP). WIPO defines IP as "creations of the mind: inventions, literary and artistic works, and symbols, names, images, and designs used in commerce. IP is divided into two categories: Industrial property, which includes inventions (patents), trademarks, industrial designs, and geographic indications of source; and Copyright, which includes literary and artistic works such as novels, poems and plays, films, musical works, artistic works such as drawings, paintings, photographs and sculptures, and architectural designs."

not relevant. In Nicaragua and in BIO-EARN, where new products and processes that were sufficiently novel were anticipated, the programmes supported activities to develop policies and processes for Intellectual Property (IP) registration and management. The evidence in the portfolio and the theory suggest that for Sida, IPR issues will need to be considered within the project design, where the innovations aimed for are a first in the world, often arising from new scientific knowledge. A different set of IPR issues arise where "traditional" or "indigenous" knowledge forms the basis for the innovation when issues of misappropriation and exploitation without benefit to the indigenous communities arise. During recent decades the scope and importance of protection of intellectual property has expanded greatly and it is not possible here to provide additional guidance to Sida. But given a common conclusion[122] that the requirements for such protection and their impacts will vary considerably between countries with a relatively advanced technological capability and those with weaker capabilities as in the many countries in the Sida portfolio, Sida should encourage additional policy studies on appropriate IPR policies together with further support for innovations.[123]

4.8 PROGRAM PLANNING AND EVALUATIONS

A notable finding from the reviews and the field work is the variability in the planning, monitoring and evaluation cycle across the portfolio [124] and plans made based on highly inadequate information. It is striking that the innovation projects had a long incubation period with several intermediate stages. They started with

[122] Commission on Intellectual Property Rights, Integrating Intellectual Property Rights and Development Policy: Report of the Commission on Intellectual Property Rights, London, 2002, p. 2.

[123] The above report, and a follow on study – Hassan, Emmanuel and Ohid Yaqub, Stephanie Diepeveen, *Intellectual Property and Developing Countries: A review of the literature*, Rand Europe, 2010; are both supported by the UK Department for International Development and provide a good overview of the issues, and trends. The more recent report makes a number of suggestions on directions for further research.

[124] We make a distinction here between planning and evaluation on the one hand versus monitoring on the other hand. In figure 3, the planning phase is at the left of the cycle and the evaluation phase is at the end. Monitoring deals with the activities during the implementation that should ideally contribute to the evaluations and also to planning the subsequent cycle.

small activities, during which the stakeholders learned about the concepts and became increasingly enthusiastic about the possibilities over time. They were then trained to apply the concepts. There were diagnostic studies and analyses of each cluster, and that was often followed by on-going reviews. The cluster projects, and in particular the Nicaragua project, have to be commended for performing the frequent assessments of progress that are essential in this kind of work.[125]

In the BIO-EARN project, the level of analysis was high only at the very beginning of the decade long project, but subsequent analysis of progress, barriers and challenges were inadequate and infrequent during the execution. BIO-EARN was the only previously evaluated project in our sample, but this evaluation occurred only once during a decade of execution. There were few on-going exercises for promoting learning. It is positive to see additional efforts at learning introduced within BIO-EARN in more recent years, notably a self-evaluation and a small study on understanding innovations, or the lack thereof in biotechnology. They were found to be very useful for this study, but they did not go far enough. They lacked sufficient breadth and depth, and there is no evidence of mechanisms to promote social or active learning by the very large group of stakeholders who were necessarily involved in the project. The studies were often hurriedly done, rarely rechecked with on-going results, and the complexities of the challenges were not often noted and acted upon. In the new version – Bio-innovate – it is simply assumed that adding a new category (biotechnology innovations for climate change) will be sufficient to harness the potential of new technology to tackle possibly one of the greatest threats to society. The lack of prior analysis before the launch of Bio-Innovate is surprising and additional analysis is recommended.

4.9 MONITORING AND LEARNING

We have noted that the on-going analysis of results was weaker than it should have been across the portfolio. This led to reduced learning by the multiple stakeholders, including Sida, and thereby reduced effectiveness. A major issue that contributed to the lack of the desired outcomes in Mozambique and BIO-EARN is the lack of a robust

[125] The project in Nicaragua has the advantage of comparatively well defined activity- to- outputs chain because it had a narrower scope of applications.

monitoring and evaluation (M&E) systems built into the interventions, resulting in slow responses by Sida to make necessary adjustments to project design and implementation plans. That leads to the strong conclusion that there was an unmet need for improvements in the speed and quality of assessments across most of the portfolio. The research networks, on the other hand, had sufficient tools developed by network members to monitor their own progress. During the evaluation, a number of stakeholders spoke favourably about the instruments used for this evaluation. It is hoped that modified and shorter versions of the instruments will be used by the stakeholders in the future.

The problem, we believe, begins with the seemingly clear definitions available on M&E. In fact, there are evaluation terms that in practice are often used interchangeably and for very different purposes. M&E systems must use explicit models or anticipated/assumed "theories of change" that allow the identification of indicators and risks at different points of time in the results chain. They also assist in the determination of which activities are being effective and which are not, as well as how and why. Without such logical analysis, indicators were not developed, monitored or reported on, and risks were not generally considered. This problem clearly affected timely interventions in Mozambique, reduced the outcomes in the other countries, and kept the focus on outputs not outcomes in BIO-EARN and many others. In the continued implementation of all cluster initiatives, and the new support to PACF and Bio-Innovate, it is critical for Sida and the stakeholders to articulate and agree on the results chain (currently implicit) and develop a set of indicators over time to allow for more efficient and effective management.

Based on the evidence in the portfolio, Sida does not need to either increase efforts at accountability-oriented evaluations nor to increase allocations to ensure compliance and controls over expenditures. It is our view that there is a strong accountability orientation and relatively rigorous process to follow up on expenditures and determine the legitimacy of the use of funds. In fact, the bulk of coordination resources is allocated to these activities. A valuable innovation within Sida would be to find a new balance between accountability and learning. It is often stated in donor documents that results-based management (RBM) will strengthen the role of evaluation, help promote an evaluation culture, encourage self-evaluation by program managers, and enhance the use of evaluation

findings in programming. But the reality is much more complex. RBM is a difficult process, often poorly implemented across organizations, where improving learning and self-improvement cultures is subject to many additional variables beyond the use of rule-based processes.

Beyond the strong support from the theory of innovations, it is practically self-evident that complex activities, requiring on-going adaptations and responding to contingent outcomes, require two fundamental managerial changes. The first is to place greater emphasis on the diagnosis of initial conditions in order to help design the most appropriate interventions. The second is to promote adaptive management, which requires clearer feedback on status, performance, design weaknesses, and emerging conditions that are not design weaknesses, but nevertheless need to be addressed. In this way, corrections are made to achieve the intended project outcomes and the intervention may even be abandoned mid-way, if the assessment so determines.

This need for quicker, more frequent and more appropriate monitoring of performance is highlighted in the literature on learning and the fact that the innovation projects require multi-stakeholder participation and cooperation to succeed.[126] Given that the initiatives aim at creating new partnerships, developing joint capacities, and promoting collaboration across a diverse group of individuals and organizations – and given that all the stakeholders are subject to multiple, often non-overlapping, and sometimes even conflicting institutional rules and incentives – adopting a common "theory of change" together with agreed upon measures of interim and longer term outcomes is simply a necessary cost of efficient and effective cooperation. Such monitoring and evaluative activities can provide for learning opportunities and transparency in implementation, thereby enhancing stakeholder trust and cooperation. These are desirable goals in themselves and, as seen in the Triple Helix/CI initiatives, key contributors to all the other goals.

A recent statement by the Asian Development Bank (ADB) supports our point on the importance of exact use of terms that superficially appear to be clear, and there are many other similar find-

[126] IDRC states that "the use of evaluation to learn and improve, is important, not just prove and to do so requires multiple reports and evaluations that form a basis for a 'Learning Forum' "; IDRC *Annual Report 2009–2010*, International Development Research Centre, Ottawa, 2010, p. 20.

ings.[127] For our purposes, it is important to highlight ADB's conclusion that RBM:

- Requires more mid-term reviews in order to more rigorously assess the likely outcomes of the projects; and
- Occupies a middle ground between monitoring and evaluation, and can improve the probability of a project's success in achieving its outputs and outcomes by solving a wide gamut of project design and implementation problems.

An overall finding here is that there is considerable room for improvement in real-time monitoring and evaluation at Sida. The requirements become more demanding as Sida moves away from simpler research training exercises where a student cohort is set on a relatively well-defined path for a period of four years. The output and outcome (as normally defined) are relatively assured if the student is well chosen and the supervisors and host institution are relatively competent and reasonably efficient. Where learning across diverse stakeholders is important, exercises promoting learning need to be built into the project design with resources allocated to them. The project design must allow for activities and resources for the establishment of the baseline and the benchmarks of progress.

[127] ADB, *Annual Evaluation Review 2010*, Independent Evaluation Department, Reference Number: RPE: OTH 2010–36, September 2010, discusses a number of relevant issues and proposes a new project performance management system at the institution. It found that operations departments needed to make greater in-depth assessments of project and program performance during mid-term reviews and carry out changes to project design. The ADB points out that as organizations focus on RBM, and on outcomes and impact of interventions, evaluation becomes more important and more relevant. It discussed a number of ways that standard evaluation processes were failing to assist in performance improvement and has taken up a improved process that it calls "Real-time evaluation" (RTE). The main focus of RTE is to provide feedback on project performance and design weaknesses on a timely basis, to allow for mid-course corrections to achieve the intended project outcomes. RTE places more emphasis on learning than on accountability. It becomes a dynamic tool to "assess and adjust" ongoing operations, thereby reinforcing the link between operations, evaluation, and results. The document spends considerable time distinguishing between different types of reviews and evaluations and discusses at length the different words used by agencies – such as review, project review, evaluation, – and some agencies also differentiate between "annual reviews" and "interim evaluative reviews" or "output purpose reviews".

4.10 USEFULNESS OF FRAMEWORK TO SIDA

Sida asked if the innovation systems and clusters ideas provided useful ways of thinking about the impact and use of research in development. Both the theory and the mode employed make excellent sense for FORSK's work. The idea provided a natural extension of research capacity building at the universities and the results achieved support the extension of the approach to other bilateral countries. The theory suggests many other possible entry points for innovation and for Sida as a whole, the theory has applications in almost all sectors. It is especially relevant for higher education, technical training, private sector development, agriculture, natural resources, environment and rural development.

The theory suggests a much more complex universe of operations considerably more challenging than supporting Ph.D. research through the sandwich model. There is a difficult allocation issue of how much should be allocated for seemingly ancillary activities such as meeting with users, working with users, communications, dissemination, networks, and new governance mechanisms. These are practical questions that Sida will need to address but it will have to abandon the idea that an 8% overhead, as allocated for BIOEARN and Bio-Innovate, is always adequate and implies efficiency. In innovation activities, these seemingly "inefficient" activities are in fact requirements, and can only be judged by their effectiveness, not by a priori assumptions that some activities are efficient and others are not. The IS approaches imply higher "overhead" costs – or what is often taken as overheads – but are in fact investments in system diagnostics, learning, cooperation and coordinating.

There appears to be very good compliance with expenditure controls. However the system of design review, changes within initiatives, and learning across them appear to be progressively weaker as we move from inputs to activities, outputs and finally outcomes. Improved systems for monitoring outcomes and assessing the impact of the activities are required to further improve management and decision making, especially in multi-stakeholder endeavours. These are necessary steps in proving impacts at higher levels of rigour. This is one of the most fundamental findings and recommendations from this evaluation and hence this point emerges at several different places in the report. An approach that appears eminently sensible would be to build in much stronger on-going monitoring for

"learning", including self-evaluative components, at a cost of 3–8% of the total project budget. This is one way to allow project participants to learn and Sida to leverage partner capacities and increase learning by its own staff.

FORSK has a clear role in taking steps to implement the successful elements from the findings in Triple Helix/CI work; to deepen the work in the existing countries and to expand implementation to additional countries. To do so effectively, they must take the initiative to transfer the lessons learned to staff in the unit, staff in other Sida operating departments and national partners.

Mechanisms within Sida that are required to successfully support programs based on systems of innovations and cluster approaches must begin with political commitment at the level of the organization as a whole. Commitment needs to be accompanied by innovative practices that are critical to implementation and for ensuring appropriate levels of stakeholder participation and support, together with attention to incentives for all the actors involved. It is key that Sida think of innovative practices that leverage partner resources, keeping in mind the staff and resource constraints within Sida. Pilot projects, undertaken in a systematic and step-by-step manner as in the ISCP group of projects, provide invaluable input in the form of practical lessons for Sida in its support for innovation, and for developing policy frameworks.

4.11 GENDER

Conceptually, gender interventions can be grouped as those that directly address gender equity issues and the narrowing of gender disparities, and those where the objectives and effects are broader. The latter category consists of projects ensuring and facilitating women's access to program and project benefits, but these projects do not otherwise focus on gender-related outcomes as primary goals.

In all the projects reviewed, there was no emphasis in the design or project goals on creating interventions that provide direct benefits to women or redress specific gender equity issues. Hence, it is not surprising that neither the assessments nor the output reports contain much gender analysis. There were no designated design features working towards gender specific goals. But the assumption that many of the interventions must have a focus on poor women appears to be a given, pointing to the success of earlier efforts by Sida to

increase awareness of this important goal. The findings note that in several clusters the economic and productive tasks that were the focus of the interventions were primarily conducted by women. So many of the beneficiaries are women and also many of these women are very poor. It is commendable that the selection process allowed for the inclusion of such activities, most notable are seaweed, mushroom, gems and minerals, tourism, and textile clusters in Tanzania. They appear to provide a number of positive outcomes towards gender equity, such as increased participation, increased knowledge and capacity, increased outputs and income earning opportunities, all promoting pro-poor and inclusive growth.

4.12 FACTORS FOR SUCCESS AND CHALLENGES

The successes of the interventions using Triple Helix/CI have depended on good planning, capacity building and training on cluster development, keeping in mind the needs of beneficiaries, and allowing for a degree of flexibility by local managers. The factors for differential success include stronger ownership fostered through extensive participation in project preparation; stronger institutional capacity of the implementing agency; leadership differentials between organizations and differences in the local context.

The weaknesses in the portfolio stem from design flaws that resulted in limited analysis to determine the key stakeholders, leading in some cases to inadequate selection and choice of key stakeholders. This was further undermined by limited consultations. Taken together, these factors often led to problems in working together towards common goals. Implementation often posed additional challenges, stemming from a lack of adequate management systems within initiatives and weaknesses within partner organisations, both at Sida and in the countries. A key weakness is the inability to provide responses to evolving needs in a timely manner due to the lack of strong, real-time, feedback mechanisms. The lack of clarity in defining who the owners are and how exactly they should have a voice in governance is a systemic weakness. Another weakness is the lack of attention to the appropriate balance between the costs and benefits of giving voice against efficiency of execution,

and this is notable in BIO-EARN. Factors that invariably reduced success include problems with the timely availability of funds at the recipient institution, often compounded by funds not being dispersed in a timely manner due to institutional weaknesses of the recipient. The strong capacity of many individual staff within Sida and within partner organizations were positive factors, but could not always be translated to comparable knowledge and capacity at the organizational level. This indicates the need for additional training for both Sida staff and partners on RBM, as well as other underpinnings of improved organizational efficiency.

5 Conclusions

A number of conclusions emerge from the review of the theory and the study of the portfolio. These can be grouped at different levels: for the individual projects, the portfolio as a whole, and for research cooperation and wider Sida operations. The detailed findings, conclusions and recommendations for the individual components of the portfolio are provided in an accompanying volume and only briefly summarized here.

At the highest strategic level, the theory reviewed for the evaluation confirms the following:

- Government policies that prioritise economic growth also prioritise innovations.
- Innovations for poor developing countries will most often mean "local or minor innovations" that increase efficiency in production, use reverse engineering and translate available knowledge to local needs and natural resource endowments. The majority of these activities are not usually classified as research, but are crucial for achieving positive growth impacts.
- To increase growth rates in poor countries it is important to link traditional and indigenous knowledge and to integrate competencies and skills from traditional sectors with modern knowledge. Increased external links to relevant know-how are important and can be supported by Sida; however, they carry potentials for both negative and positive outcomes.
- In poor countries:
  - firms tend to be weaker;
  - the innovation systems are more dependent on public policy as the demand side is weaker and the systems more fragmented; and
  - the role of civil society organisations in promoting innovations can be more important than in richer countries.
- The adoption of a systems framework allows for an examination of the binding constraints to improved performance and the development of a way to prioritise between alternatives, thereby assisting decisions as to where (and how) interventions can be made and helping determine a proper sequence.

- The new knowledge theories and Triple Helix concepts provide a useful method for Sida to combine research and capacity building with short- and long-term poverty reduction outcomes.
- The IS/Triple Helix/CI approach provides additional co-benefits of increased trust and social capital, important factors that promote growth, and also contribute to improved governance.

The evaluation portfolio included ten distinct programs, with some sub-programs. It was found to be grouped into four major ways of working for Sida (elaborated in the portfolio description section in chapter two). The first and most distinct group were the four country projects in Uganda, Tanzania, Mozambique, and Bolivia, that experimented with the Triple Helix and clusters, and in Nicaragua the work began with the same approach and then moved to a variation, focused more on strengthening the universities and their coordinating bodies. The two projects in biotechnology (BIO-EARN, Bio-Innovate) provided for an experiment to extend traditional sandwich training and research support models to provide a base for an innovation platform. The three networks – PACF designed to further the development of TH/CI work in Africa; UNIDEV to understand the role of universities in the innovation processes, and Globelics, a broader global network of researchers. The heterogeneity of the portfolio has been discussed (in sections 2.1 through 2.4) and how that affected the study design. This heterogeneity also poses some challenges in drawing strategic conclusions. The social science and policy study networks provide for a narrower group of outputs and outcomes, according to their own goals, and the knowledge outputs enrich the understanding and conceptual frameworks on IS and the roles and limitations of universities. They provide one of the complementary sets of knowledge outputs that Sida expected from the portfolio, and the outputs from these enrich our understanding of IS and the role of Universities. Some of the outputs are used in the theory section (Chapter 3) and are captured more fully in the survey in reported in the parallel volume.

The five country projects had significant degrees of comparability, and speak more directly to findings on economic outputs from IS/TH/CI set of interventions. Many of our conclusions are based on the positive findings as well as the challenges faced in this subset from the portfolio.

The BIO-EARN project on the other hand, while succeeding in delivering the traditional outputs and outcomes (numbers of people

trained, scientific publications, capacities for research) – all used to deliver new training, secure new grants and so on (listed in the findings) – did not achieve new product/process outcomes and economic impacts planned. We conclude that the concepts used remained firmly rooted in the traditional "linear view" of research leading to limited application and use. Our investigation identified a number of contributing factors to the low innovation outcomes in the absence of an IS approach, including:

- Imprecision in the use of Innovation terminology, with research and innovation used interchangeably;
- difficulties in improving research *management* skills;
- university level administrative bottlenecks;
- procurement issues at participating institutions;
- challenges in linking to the weak local private sector;
- poor analysis of the set of constraints to innovation in bio-technology; and,
- a low allocation of resources to "coordination" and "learning".

The negative findings add to the weight of the strategic conclusions summarised below from the more homogenous national interventions. But by themselves, negative findings from a single intervention are less strong in evidentiary terms. The Bio-Innovate project that followed, is too new, with no results at the time of the evaluation, and so does not provide for any immediate lessons. We suggest actions by Sida to increase the likelihood of successful innovation outcomes for Bio-Innovate based on the findings on BIO-EARN (see Recommendations).

We found that FORSK defined the concept of innovation for the TH/CI interventions in terms of the use of ideas, technologies, or ways of doing things that are new to a specific context while definitions were not provided for the other interventions. FORSK found that the model brought together the expertise and experience of universities, business enterprises and governments to facilitate collaboration and innovation. FORSK tested the idea of clustering in a proactive and experimental manner. Specifically, it tested ideas and models to promote the 'use of research' and innovations, where universities were the central actor. Pilot projects, as undertaken here in a systematic and step-by-step manner, are valuable, providing practical lessons for supporting innovations and developing required policy frameworks. The ideas of innovation systems and clusters (reviewed in detail in Chapter 3) provided FORSK with

a conceptual tool to combine the role of capacity development in research with the goal of promoting economic growth processes in poor countries through greater direct economic impacts. Sida's broader assessments of the five country portfolios as developed in 2006 were excellent, including the assessment of risk and potential for non-achievement of objectives.

Almost all the objectives and hypotheses hold in the case of the four more successful cases (the exception being Mozambique). Four of the five country projects and two of the three network projects were judged "efficient" to "highly efficient". Further, they have all been mostly effective in increasing both institutional and human capacities; three of the five country projects scored particularly high. In the Triple Helix/CI group, poverty-reducing economic benefits were observed across multiple clusters in Tanzania and Uganda. Projects were notable in their success as pilots and vehicles for wider learning by various groups. They improved government policies and increased support to cluster firms in the two countries, where the project activities had more time to achieve impacts and where there was greater prior policy interest on the part of the government.

The selection of activities supported in the portfolio indicated good judgment and capacity at Sida. At the same time, very low linkages between activities in the portfolio, the lack of an agreed upon "theory of change" across the portfolio, and a lack of systematic attention to learning, often within interventions and almost always across the portfolio, are common features in the portfolio, and point to the need for increased capacity at Sida and among the partners for implementing the ideas from innovation systems.

Innovation systems theory and concepts provided key insights into how to promote innovations with new knowledge theories, while the Triple Helix concept provides a useful method for Sida to combine research and capacity building with short- and long-term poverty reduction outcomes, as well as a number of additional outcomes (e.g. trust and social capital) that also promote growth. There was strong confirmation that the innovation system and cluster theories, especially as shown in the results of the four country interventions, provide a very good and useful framework. The findings support the demand by the Swedish government to focus on greater use of increased capacity leading to positive impacts on development and allows Sida to respond positively to that demand. However, no single, exclusive model, or "way of working" was identified that *best*

linked education, research and knowledge use with enhanced growth and poverty reduction. The different ways of working in the portfolio can complement one another. There would be additional ways of working to promote innovations, and these need to be further explored.

The theoretical background provided a number of hypotheses that were tested in the evaluation, and most were confirmed in the findings from the interventions using the IS/Triple Helix/CI framework. The positive "innovation" results in the more effective country interventions confirm that the framework is useful for linking capacity building results to poverty reducing outcomes. The findings show that the framework allows Sida projects to demonstrate greater use of the capacity built for more tangible poverty reducing growth impacts within a short term. The findings suggest that the shorter term outcomes can be sustained, and help build a base for longer-term positive impacts.

The review noted the increasing popularity of cluster strategies in the European Union and other OECD countries, and the fact that a number of Cluster Initiatives have also taken place in developing and transition countries through donor initiatives. Most other donor initiatives in poor countries focus more on firm competitiveness and less on linkages with knowledge systems as found in the Sida portfolio. As these ideas have expanded in use, the full range of work by all agencies was found to be too large to be fully reviewed here. But the uneven interest and engagement among donor agencies with the ideas of innovation, and on related research in or for poor countries, suggests great value in further work by Sida to refine and expand the use of these ideas over time, in additional countries and new sectors. For best results, Sida should do this work in partnership with other stakeholders.

The review found strong potential for additional use of the concept of innovation in other departments at Sida and noted that IS ideas are being consciously adopted in "Business for Development (B4D)" and have been mentioned in the area of health systems. For Sida as a whole, the extensions have immediate applications in almost all sectors, but would be especially relevant for higher education, technical training, private sector development, agriculture, natural resources, environment and rural development. There is inconsistency within FORSK, and across Sida departments in the terms used to describe innovation concepts and the interpretation of their

meaning; this problem can be reduced through greater efforts at a shared understanding and lexicon.

The extension of the ideas and practice requires greater team work and sharing of knowledge than was found in the portfolio within FORSK. Further, it requires management support for common use in other Sida departments and partners. The work undertaken within Sida makes it well-positioned to develop wider applications of these concepts, with clearer definitions and examples of innovations at different levels and in different sectors. Sida can incorporate inputs from other sectors within the organization and aim for an agency-wide conceptual framework. At the same time, while universities are clearly potentially powerful vehicles for promoting development, they would not be the lead organisations in all innovation-related activities, and extensions will require alternate design options.

For FORSK and other research funding agencies, the most important insights for research that emerge from innovation systems theory include:

- that there is a need to understand the dynamic interactions between the "supply" of new ideas and knowledge from research and the "demand" from the potential users;
- that innovations, therefore, require links and interactions between the organisations and actors on both the supply and demand side to arrive at feasible applications; and,
- that the desired "outcomes" – innovations and growth – are a result of a number of different factors and complex interactions.

The successes of several clusters, such as mushrooms and seaweeds, confirm many elements of the theory and hypotheses developed. They show that "working with and reworking the stock of knowledge is the dominant activity in innovation." The findings of the low direct impact of user demands on research outputs in the Triple Helix/CI projects and the low uptake from BIO-EARN research results by firms confirm that ***the bulk of innovations in poor countries are not immediately based on new research-based knowledge***. The findings confirm that innovation outcomes require a wider range of actors to cooperate, that these interactions happen at multiple levels, and that they require flexible linkages between actors and participatory processes, so the actors can understand one another and work together towards common goals. This in turn ***requires intervention designs that are balanced,***

flexible and iterative, with some understanding of the different institutional rules and incentive frameworks that govern the different actors. The theory highlights the critical role of human capital – education, experience, and social and intellectual capital – in promoting growth, but there remain many unresolved tensions between the theory and practice on their prioritisation and the sequencing of the activities. Ultimately these issues must be resolved according to local contexts and require ongoing attention to improve practice.

The findings in all TH/CI projects and even more so in BIO-EARN, also highlight that extending linkages from knowledge institutions to firms is not a simple task. Firms tend to first draw on knowledge inputs for their innovative activities from other firms, and only later, as they deepen their own innovative capabilities to include design and technology development, do they begin to interact in significant ways with research organisations. The reason for this appears to be that economic actors need to build up some internal capacity and motivation in order to absorb research and development-derived knowledge from external sources. Thus it is not easy for public research and development organisations to link to industry, and this is even more difficult in poorer countries. The differential results between Mozambique and other countries adds to the evidence that the poorer the local conditions, the weaker the links within a "system of innovation." This does not mean that going from research to application is not possible, but that this process requires greater than usual effort and more detailed understanding of key linkages than standard capacity building projects. The findings confirm that ensuring research and knowledge outputs meet user needs is a labour-intensive process, and resources for this must be provided as a part of the operational cost of obtaining value from research. Coordination requirements between the different actors need to be distinguished from unproductive and inefficient "administration or overhead costs," as was often stated in the BIO-EARN approval documents.

The innovation systems concepts provide a richer understanding of the factors and their interplay, and offer useful guidance. But they do not always lead to easy policy prescriptions, and more research and experimentation is required concerning desirable public policies that promote innovations in poor countries. There is a need for Sida to implement processes that record good practices in the work supported in the portfolio and to deepen the work done in this

evaluation by building stronger components within interventions that can measure the effects of such policies. Many concepts discussed here and noted in the findings from the portfolio – learning, capacity building, social learning, learning-by-doing; learning and empowerment, positive feedback loops, the creation of network effects and enhanced trust – are inputs to increased "social capital". Social capital concepts have no easy quantitative measures, but they are at least as important as the more easily measured "financial capital" concepts for growth. External inputs must always involve locally-generated social processes, activities and systems thinking, network building, dialogue, knowledge management, and evaluation. Change processes are inherently difficult to monitor and evaluate, and always require a more flexible and iterative process of planning to match the evolving process of change. This appears to pose challenges to Sida's existing processes.

Some common shortcomings across the portfolio included low linkages between activities in the portfolio, the lack of an agreed upon "theory of change", and a lack of systematic attention to learning within interventions (often) and across the portfolio (almost always). Several deficiencies in knowledge management were noted, beginning with deficiencies in linking and making easily accessible project documents, critical achievements and challenges over the project life. Another finding noted across the portfolio is that monitoring remains a critical deficiency and needs to be improved. This requires more rapid and better quality periodic evaluations of programs and projects. The information from the monitoring should be directly applicable, providing information to management and to the different actors who need to cooperate with the information required to improve the operations of the project. Evaluations, focused on impact and/or accountability, should lead to on-going quality improvement. While financial audits were not examined in detail, it was observed that financial reviews appear to occur with greater regularity than other types of review and did not appear to be the source of deficiencies. The need for more rapid and better quality assessments should not be interpreted as more mandatory reports at specified times. The deficiencies cannot be resolved this way, unless the mandatory reports provide meaningful information and are linked and easily accessed by all. Otherwise, they only add to the reporting and review burden.

An Innovation System (IS) perspective implies a more complex universe of operations, more challenging than supporting PhD

research, where learning and coordination has to be provided for more explicitly. An immediate operational consequence is to abandon the idea that all management costs are simply an overhead cost that suggests inefficiency. In innovation activities, the seemingly inefficient activities are in fact required and can only be judged by their effectiveness, not by a priori assumptions that some activities are efficient and others are not. None of the activities in the portfolio had adequate systems for monitoring outcomes and assessing impact, which are required to further improve management and decision making, especially in multi-stakeholder endeavours. The process of developing indicators is itself a valuable part of the design process, helping or forcing participants to be clear with each other about what they mean when they talk about "results". Money spent on indicators and monitoring should be proportional to the overall investment and monitoring poorly developed indicators can in fact be more negative than the mere waste of time and resources. An approach that appears eminently sensible would be to build in much stronger ongoing monitoring that could be initiated with a higher allocation within project budgets. This provides one way not only to allow project participants to learn, but also to allow Sida to leverage partner capacities and increase learning by Sida staff.

Sida is again at an important moment of transition and restructuring, and its operational resource highly constrained. Knowledge management, outreach and various types of partnerships need major improvement and engagement. Interdisciplinary and intersectoral activities are inherently difficult, in part because of the ways in which research and education are organized in the world and in part because of the structure of almost all bureaucratic organisations. The answer will not be found in seeking to change these structures completely; they serve certain purposes very well, such as dealing with problems of research or administration that fall within their purview. What is required is to find spaces within these structures that are commensurate with interdisciplinary and systemic problems. This requires managerial, personnel and incentive structures, which currently appear to obstruct individuals and programs, to work across organizational structures at Sida and partner organizations. The conclusions support the instructions by the Government of Sweden to Sida that it make room for flexibility and innovation in its contributions through innovations in how Sida supports partner countries and in work processes.

There are ways in which greater efficiency and effectiveness can be achieved, given the anticipated and on-going restraint in Sida staff numbers. It means finding ways to leverage the partnerships with the different stakeholders that Sida works with that includes the many important research funders who are members of the International Forum of Research Donors (IFORD) network, who have a shared interest in innovation, economic growth, higher education and clusters. But PRI's review shows that donors can be slow to add to their portfolio and could find Sida's assistance crucial in advancing work focused on universities and higher education in order to establish strong relationships. Sida should consider taking a lead in highlighting the multiple roles of universities and knowledge institutions given its long and successful role in building such capacity. New partnerships are most likely to emerge from documented successes and lessons for partners.

Some suggested lessons are that Sida and the partners should review and agree to new ways to learn, and to remove impediments to implementation efforts. Positive directions for CIs would include an expansion of types and numbers of resource persons involved with relevant backgrounds in key areas of importance, both from within and outside the universities. Significant additions of student involvement in the CI work could improve long-term capacity building of graduates, and of teaching and research staff. Sida may consider experiments with new roles for facilitators, including some options for fee for performance. Possible ways to enhance incentives for all stakeholders on a performance basis together with periodic, possibly annual, reviews of performance on each cluster supported could be useful design experiments. The shift in location of the projects from the university level to the national level may improve or hinder some of the CI project goals in Mozambique and Tanzania, for example. There are a number of risks going forward including efficiency of the new arrangements for coordination; that the initiatives have rested on voluntary contributions of facilitators. All CI projects should have greater integration and links with the much larger and more traditional bilateral research capacity-building projects. In future redesigns the role of research and "technology transfer" needs to be re-examined and perhaps provided for more explicitly and with resources than evinced so far. The challenge of financing and capital for cluster producers and for researchers will need to be examined to see different possible supportive roles for Sida, governments and the

financial sector. There remains much to learn about cluster initiatives and how they can be made more effective and useful. Finally, working at regional levels, as in BIO-EARN and Bio-Innovate, requires much greater attention to institutional arrangements as the layers of administration and the links required for effectiveness, are greater and inherently more complex than national level interventions. So regional projects require greater engagement on the part of Sida at many different levels and improved, ongoing assessments of whether the required arrangements are present and working effectively.

6 Recommendations

The evaluation leads to the following recommendations and they are organised from the broader and more strategic issues to the narrower and project specific issues. The recommendations have not been ranked as they are each important in different ways.

At the ***strategic level*** we recommend that Sida:

1. Maintain and expand work under the IS/Triple Helix/CI framework (especially as designed in the two more successful East African countries) to other sectors and in additional countries. This would have immediate applications in most sectors, and be especially relevant for higher education, technical training, private sector development, agriculture, natural resources, environment and rural development.
2. Consider investing in knowledge sharing and outreach activities with a specified allocation to inform stakeholders in their partner countries about the portfolio. To be most effective, knowledge sharing must be continuous, supporting project participants over the life of their initiatives.
3. Explores how to play a more active role in supporting the participation of universities and other knowledge producers as valuable partners in projects developed within the IS/Triple Helix/CI framework, including supporting cooperation and linkages between networks such as PACF, Globelics and UNIDEV.
4. Treats investment in interventions in additional countries as new experiments, taking time to examine the specific conditions in each country and to allow for necessary local modifications.
5. Encourages systematic pilot projects, building on the ones in the portfolio, to develop and learn additional lessons on how to improve support for innovation and how to develop appropriate policy frameworks.
6. Consider improved "Knowledge Management" systems as a critical part of its search for innovations in its work processes as per the instructions by the Government of Sweden. This should consider three inter-related elements – improved access to existing documents that relate to a project, issues, and lessons; new balance between accountability and learning when it comes to

monitoring and evaluation; and, more effective and efficient team work.

7. Build two important principles in to the future designs for all projects that are developed and supported under the IS framework namely: on-going assessment and incentives for improved performance.
   - 7.1. There should be a larger allocation for on-going assessments of achievements and challenges. These must be transparent, allow for full participation by all stakeholders, and be designed to provide for on-going management to improve performance. Monitoring poorly developed indicators is a waste of time and resources, and may be harmful. Sida could consider requiring stronger on-going monitoring at a cost of 5–8 % of the total project budget, with more complex initiatives possibly having larger allocations. This would allow project participants and Sida staff to learn from the projects.
   - 7.2. Consider experimenting with designs that include incentives for improved performance, such as the reallocation between poorly performing activities to those which indicate better performance.
8. FORSK designate a work group to support the transfer of knowledge and experiences to staff within FORSK and across other units at Sida, particularly in the health, agriculture and natural resource sectors and in private sector development.
9. Undertake work on an agency-wide conceptual framework, with well-defined terms, taking care that words like "innovation" and "systems" do not simply become a new flavour without content.
10. Recognize and act on the importance of coordination costs, generally viewed as reflections of inefficiency, given that innovation necessitates increased capacity at both Sida and partners organizations.
11. Seek greater efficiency and effectiveness by improving their internal processes through analysis of process steps that could be simplified, eliminated or improved qualitatively; and finding ways to leverage their partnerships with their different stakeholders by allowing greater freedoms to the partners while increasing the focus on outcomes and lessons and decreasing the attention to the management of inputs.
12. Supports deeper analysis of the social and economic benefits that stem from its support to universities. This and other

requirements for new knowledge and practice on IS could be designated as elements of work within regional and global research and knowledge networks supported by Sida, such as Globelics and UNIDEV, with resources provided for dissemination of knowledge. Overall, Sida project interventions should work to strengthen linkages between regional and global networks and country level bilateral projects.

At the ***implementation level***, there are a number of specific recommendations made for each component of the portfolio and it is recommended that Sida considers the specific suggestions to ensure improvements in design and resource allocation in each component based on the projects' experiences to date. A brief summary is provided here.

13. In all the TH/CI interventions reviewed, Sida should encourage the inclusion of additional numbers and types of resources people (with more diverse backgrounds and expertise as relevant in areas of importance such as accountants, financial analysts, economists, market specialists, business consultants and social scientists) and especially the levels and numbers of students engaged to have wider impacts. In all the TH/CI interventions Sida must develop with its partners, a robust system that reports base lines, annual progress, challenges and options, that would allow the different stakeholders, and the national management committees to know jointly and learn – what was working and what was not – to allow for quicker adjustments to both project design and implementation plans, and also provides improved information for future evaluations.
14. Sida should explore with the national partners in all four countries, design changes suggested from the theory and evidence on innovations and use of research capacity, shifts in resource allocations from being concentrated on capacity building research towards additional activities that promote use of knowledge.
15. In addition, in the specific case of Mozambique, we recommend that Sida reviews the impediments to previous implementation efforts to ensure their removal. In Bolivia we recommend increased resources for the TH/CI and innovation components and for increased integration with the other traditional research program. In Tanzania, Sida should take advantage of the opportunity for an expanded CI programme under the Tanzania Private Sector Foundation supported by additional donors to

leverage wider collaborations with additional partners. Also in Tanzania, the change in the management of the clusters initiative from the university level to the higher national level provides for both opportunities and new challenges and these needs to be actively managed.

16. In Bolivia we recommend that Sida takes steps with the national partners to increase the levels of participation of stakeholders in general and encourage the large bilateral project towards documentation that are based on improved RBM framework and are outcome oriented.
17. For Nicaragua, we understand that government policy does not provide for bilateral research cooperation at this time. The recommendations are that Sida should support a follow up exercise after 18 months to learn about the longer term outcomes from this initiative and use the lessons learnt in improving the capacities for innovation by the universities in other bilateral programs.
18. It is strongly recommended that Sida urgently considers additional steps for the Bio-Innovate program with the possibility of reallocation of resources based on new studies, with sufficient depth and scope and considerable stakeholder involvement that can improve the potential for innovation outcomes. The same study or a linked activity should include support for developing an improved M&E framework to include indicators and a set of "practices" that allows all stakeholders to work towards the larger systemic goals. Given the large size and long period that the BIO-EARN project was active, and flaws in execution, it could provide for improved learning of lessons that in turn could strengthen the Bio-Innovate program and increase the probabilities of the desired goals being achieved.
19. For the PACF, we recommend a greater focus on providing a platform for knowledge sharing and the expansion of the knowledge base on clusters and cluster based development initiatives in Africa and move away from management of cluster initiatives on a pan Africa basis.
20. For both network projects – UNIDEV and Globelics (and in the cases of other international networks that are supported in the future) Sida should see itself as a more pro active "partner" and "network member" that should go beyond the provision of finances alone – to assist in the dissemination of results at forums where Sida has additional access to policy makers than the researchers; encourage links to enable the desired processes of

change in partner countries; and through links encouraged in the design and resource allocations of international networks to incorporate national activities – the cluster projects and other bilateral university and research council beneficiaries of Sida support in low income countries – which could make the knowledge generated more directly relevant to national users in universities and allow them to learn more effectively on their specific situations. The networks also need to widen their membership to include more natural scientists and engineers.

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Annex 2: Glossary

Innovation: There are three levels of innovations that are defined by the OECD.

1. The use of something that is new to the world; or,
2. The use of something that is new only to the market where introduced; or,
3. The use of something that is new only to the firm, even if it has already been implemented by other firms or organizations.

Innovations can include new products, new processes or new services. Services can include marketing, a social or health service, which may be a market or non-market service. An innovation can be *minor* – a small change in the product mix, or process, that has a small impact. Or an innovation can be *major* – a large change that has major and ongoing and even global impacts over decades. An example here is the internet, which emerged from scientific laboratories some 40 years ago, and is continuing to evolve, expand and create dramatic restructuring of how the world undertakes most activities. There are some who anticipate that biotechnologies would also unleash a similar transformation to many economic activities and in health outcomes.

Research: Research has been defined by OECD as "creative work undertaken in a systematic fashion" in order to increase the stock of knowledge and the use of this stock of knowledge to devise new applications. Until 1983 the definition only covered enquiry in natural sciences, then the subject area was widened to include knowledge of men and women, culture and society. While use of knowledge is listed in the definition of research, the boundaries of research exclude many types of knowledge (and innovation) activities – testing and analysis of materials, components, products, processes; feasibility studies; routine software development; general purpose data collection; process optimization and later stages of drug trials.

Science is a system of knowledge acquired using specified methods of observation, description, experimentation, and validation and often also includes the tools required.

Technology is a bundle of goods, which include not just a piece of machinery, but also *combination of knowledge* – the skills of workers and technicians, standards, raw materials, designs, drawings,

specifications, and tacit knowledge that is not specified in written form but comes from experience to produce a product or service.

Knowledge is a much larger set that includes scientific and technological knowledge, but also traditional knowledge of medicines, ecosystems, social formations, and the sustainable use of resources. It also includes knowledge gained from social experiments (and social innovations) such as large-scale vaccination and health-delivery programs or micro finance. Codified knowledge is documented, as in reports or is systematized in some other way while tacit knowledge is what is often not possible to put in a manual and is generated by human experience and practice.

Ratings Scale Used:

- For rating of efficiency and effectiveness of individual interventions the following terms were used, similar to the terminology used by the evaluation group at the World Bank.
- Highly Satisfactory: Noted good progress toward all major relevant objectives, with high development impact on one or more objectives and with no major shortcomings identified.
- Satisfactory: Achieved acceptable progress toward all relevant objectives and relatively few shortcomings were identified.
- Moderately Satisfactory: Achieved acceptable progress toward many relevant objectives and very few major shortcomings were identified.
- Moderately Unsatisfactory: Did not make acceptable progress towards many relevant objectives, and/or did not take into adequate account some key development constraints or included significant shortcomings.
- Unsatisfactory: Did not make acceptable progress toward most of its major relevant objectives, and/or did not take into adequate account key development constraints or included major shortcomings.
- Highly Unsatisfactory: Did not make acceptable progress toward any of its major relevant objectives and did not take into adequate account key development constraint, and also included some major shortcoming.

Sandwich Model: Sida has very often strengthened research capacity in its bilateral research cooperation program through research training that use the so-called "sandwich mode". Here students spend time at Swedish universities for coursework, experiments, data analysis and writing of the results. The empirical research is formulated with a local perspective and the data collected

from the local context. Often there are also national supervisors and at a subsequent stages, the new PhDs graduates also take on supervisory roles of subsequent new students working with their Swedish counterparts ('closed sandwich').[128]

Clusters: Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, and associated institutions in a particular field that are present in a nation or region. Clusters arise because they increase the productivity with which companies can compete. The development and upgrading of clusters is an important agenda for governments, companies, and other institutions. Cluster development initiatives are an important new direction in economic policy, building on earlier efforts in macroeconomic stabilization, privatization, market opening, and reducing the costs of doing business.[129]

Triple Helix: Triple Helix' describes a close relationship between universities, industry and government as a potential systemic relationship where the three actors become more interdependent and with greater coordination to promote innovation. This concept also proposed much greater recognition for industry, not only as a user but also as a producer of knowledge. And, on the other side, universities not only generate knowledge and capacity, but also new innovative companies. Eklund, discusses that some innovation scholars such as Lundvall attempted to distinguish between the strands of formulation – innovation as a product of learning between user producer interactions, or innovation as an output of science in some Triple Helix and knowledge production models. Irrespective of their relative importance, the Triple Helix formulation does help re-establish the importance of universities and research policy with innovation policies, though now through greater links and interactions and not as an island of knowledge and research.[130] All of these ideas are integrated in the idea of "Cluster Initiatives" as a policy implementation tool to foster linkages between local stakeholders to promote innovation and growth.

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[128] Boeren, Ad, Tom Alberts, Thomas Alveteg, Erik W. Thulstrup, Lena Trojer. 2006, *Sida/SAREC Bilateral Research Cooperation: Lessons Learned*, Sida Evaluation 06/17, Department of Evaluation and Internal Audit, 2006, p. 17.

[129] See Porter, Michael, The Competitive Advantage of Nations. New York: Basic Books, 1990.

[130] See for example Lundvall, Bengt.-Åke, (ed.), National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning, London: Pinter Publishers, 1992., and Eklund, Magnus, Adoption of the Innovation System Concept in Sweden, Uppsala Studies in Economic History 81, Uppsala, 2007.

Annex 3: Evaluation Team

Amitav Rath

Amitav Rath is the team leader for the evaluation. He was trained in science and engineering at the undergraduate level in India. He then worked on his Masters and Ph.D. at Berkeley in Operations Research with a focus on economics, statistics and systems analysis. He has taught in India, Canada, Jamaica, Sweden, and the USA in areas of management, economic planning, technology and innovation, and, on energy and environment. He worked at the International Development Research Centre (Canada) for over ten years and was the manager of programs in Science, Technology, Energy and Economics during this period. At present he directs a consulting practice at Policy Research International based in Ottawa, is an adjunct professor at the Indian Institute of Technology, Bhubaneswar, and is also appointed "Professor Extraordinaire" at the Institute for Economic Research on Innovation (IERI) at the Tshwane University, South Africa. He is an editor of the journal Comparative Technology Transfer and Society. He has been a member of the Technical Advisory Group for the World Bank trust funds on energy for five years; recently completed work on Biotechnology for Development; a review of selected S&T capacity building issues for IDRC, worked on South-South cooperation for the UNDP, evaluated several science and research support initiatives of the IADB, DFID, UNESCO, IDRC and Sida, including as an adviser to the large DFID funded project on "Research into Use", focused on applications of natural resources research in poor countries of Africa and to IDRC on science indicators in Africa.

Francisco Sagasti

Francisco Sagasti has been involved in science and technology policy making, research and evaluation since the 1970s. He has been a member of the boards of the Industrial Technology Institute, the Mining Technology Institute and the National Science and Technology Council in Peru, and also chairman of the board of the Program on Science and Technology at the Prime Minister's Office. He chaired the UN Advisory Committee on Science and Technology for Development and also has been a member of the UNU Advisory

Committee, the UNESCO Advisory Committee on Science and Technology Policy, and is currently a member of the Board of the Canadian International Development Research Centre and of the International Advisory Committee of the Lemelson Foundation (which supports invention innovation in developing countries). He has been a member of the Development Effectiveness advisory group at the UNDP. He was a team member in an evaluation of the SAREC Program of capacity building for science and technology of the Swedish International Development Agency, has reviewed the financing and budgeting procedures of the United Nations Secretariat, has been member of the team that evaluated the implementation of the Paris Declaration on Development effectiveness, and was an advisor to the Independent Review Team of the Consultative Group on International Agricultural Research. He has published extensively on science and technology policies, development cooperation and related issues. Most recently he worked on "Science, technology and innovation in Peru" prepared at the request of the Prime Minister of Peru; and a notable publications are "Structure; Knowledge and Innovation for Development: The Sisyphus Challenge of the 21st Century"; and "The Uncertain Quest: Science, Technology and Development". He is also the author of numerous papers, and has been a member of the Editorial Board of the international journals Foresight, World Development, Technological Forecasting and Social Change.

Bitrina Daniel Diyamett

Bitrina Daniel Diyamett is at present the Executive Director of ATPS-Tanzania, an NGO focused on development and policy research in the areas of STI policy. She holds a Masters degree in Science and Technology Policy from Research Policy Institute (RPI) Lund University, Sweden, and has completed her PhD at the University of Dar es Salaam in June 2010. Her research is focused on "Inter-organizational Linkages and Innovativeness in Least Developed Countries: The Case of Metal Sector in Tanzania". She began her career in STI policy has been involved in a number of consultancies and publications in the area of science, technology and innovation policy. Much of her past research work, consultancies and publications has focused on systems of innovation in the context of least developed countries. She has also had various opportunities to work in and participate in some of the projects that form the universe for this review.

Mario Francisco Bazán Borja

Mario Bazán is a researcher FORO, Lima. He has a first degree in economics and graduate courses at the Pontificia Universidad Católica del Perú. He has worked as a Researcher and Manager at FORO since 2001. Mario was involved in the review of the effectiveness of Sida/SAREC funding of regional and international for 2000–2005 for the Government of Sweden and was also a member of the PRI team that recently completed the evaluation of UNESCO Science Policy. Notable work includes several studies for the Swiss Agency for Development Cooperation; the review of CGIAR; studies for the UNDP and the World Bank; the evaluation of the implementation of the Paris Declaration required by the OECD.

Fernando Prada Mendoza

Fernando Prada is also a researcher and staff member at FORO, Lima. He has a first degree in economics at the Pontificia Universidad Católica del Perú and a Master's in Public Policy from the University of Michigan. He has worked as a Researcher at FORO since 1999.

Fernando has also worked in the Inter-American Development Bank as a Research Fellow, examining Latin American countries' performance regarding the Paris Declaration; an adviser at the Prime Minister's Office where he was involved in the coordination, monitoring and evaluation of public sector programs; and also at the Institute of Development Studies (University of Sussex– UK). He has worked in a number of projects as researcher at FORO and also as a consultant. Notable work include a diagnosis about the UN budget and finance process and structure; a study on financing development for the UNDP.

Andrew Barnett

He is currently a Director of the UK firm The Policy Practice Limited, which focuses on political economy analysis, science and technology policy, and evaluation in development projects. He has three decades of work experience on innovation systems, both in theory and practice. Initially this was at the Science Policy Research Unit at Sussex University, where he was leader of the developing country programme, and then at IDRC. Most recently he examined one of DFID's large research programmes on Crop Post Harvest to learn the lessons from their innovation systems approach and has been the chair of the group advising DFID's Research Into Use Programme

on innovation systems; he was part of the design team that advised DFID on the monitoring and evaluation of its research and innovation strategy; last year he evaluated the IFAD's Innovation Mainstreaming Initiative; and in 2009 completed an evaluation of Swiss government (SDC) aid to "development research" in and for developing countries. He provided inputs to the theoretical framework and donor mapping exercise and to quality assurance (QA) support to the evaluation.

Jacques Gaillard

Former deputy and acting director of the International Foundation for Science (IFS) in Stockholm, Sweden, former director of the Office of Policy and Coordination of the Department of Technical Cooperation at the International Atomic Energy Agency (IAEA), Jacques Gaillard is at present senior researcher at the Institut de Recherche pour le Développement (IRD) in Paris, France and an associate consultant of Policy Research International. He has a PhD in Science, Technology and Society (STS), his main areas of interest and expertise are science, technology & innovation policies and indicators, evaluation and impact studies; comparative analysis of international S&T cooperation policies for sustainable development and environment; international S&T migration. He has more than 40 publications in peer-reviewed journals in S&T policies, sociology of S&T, scientometrics, evaluation and impact studies, etc.; more than 50 papers presented in scientific meetings and more than 30 chapters in books,14 books as editor and 5 books as author. He is an adviser and provides support for QA.

Annex 4: The Terms of Reference by Sida

TERMS OF REFERENCE

STRATEGIC EVALUATION OF SIDA'S RESEARCH SUPPORT TO INNOVATION SYSTEMS AND CLUSTERS.

Background and rationale

Two developments warrant a strategic evaluation of Sida's support to innovation systems and clusters at this point in time. One is the increased attention the concepts have received among researchers and policy makers in recent decades, initially in high income countries to address the issues of economic growth and competitiveness. For the same reasons – but under rather different conditions – investments in innovation systems and cluster initiatives are increasingly being studied and included in national growth and development strategies of low-income countries.[131]

Stemming from the late 1980s and empirical research on innovation that drew on institutional and evolutionary economics, the innovation systems concept was firmly established within academia by the publication of the volume *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning* in 1992.[132] During the 1990s the innovation systems concept was adopted and increasingly promoted by the OECD, and in particular by its Directorate for Science, Technology and Industry (DSTI). This twin legitimacy from the academic community and the OECD gave the innovation sys-

[131] See, for example, Oyelaran-Oyeyinka, B. and R. Rasiah, *Uneven Paths of Development: Innovation and Learning in Asia and Africa*, Cheltenham: Edward Elgar Publishing, 2009; Larsen, K., Kim, R. and F. Theus *Agribusiness and Innovation Systems in Africa* ,Washington D.C.: The World Bank, 2009; Lundvall, Bengt-Åke, Joseph, K.J., Chaminade, C. and J. Vang (2010) (eds.) *Handbook on Innovation Systems and Developing Countries: Building Domestic Capabilities in a Global Setting,* Cheltenham: Edward Elgar Publishing).

[132] Lundvall, Bengt.-Åke, (ed.), National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning, London: Pinter Publishers, 1992.

tems concept a particularly strong seal of approval and led to it achieving almost immediate impact.[133] The heightened attention put on the importance of research and the central role assigned to universities sets innovation systems apart from previous policy approaches that aimed at increasing innovation and economic growth. The cluster concept follows a similar evolutionary path. Although economic geographers had long studied the agglomeration of economic activities in certain places, it was not until the business economist Michael Porter launched the cluster concept in the 1990s as an analytical construct to investigate the competitive edge of nations (and later regions) that it really caught the attention of policy makers.[134] The OECD has endorsed and promoted the cluster concept as a tool to achieve increased collaboration between universities, governmental agencies and the business community in the pursuit of economic growth and innovation.

Hence, two decades in the making the policy and academic impact of the innovation systems and clusters concepts is well established, and on the rise in low income countries, including those that partner with Sida. For Sida this raises the question of how it should relate its activities to the increased attention and demand for investments in national innovation systems and cluster initiatives in the countries and regions where it operates.

A second reason for the evaluation is the recently adopted *Strategy for Sida's support to research cooperation 2010–2014*. Here it is stated that 'opportunities for utilizing research as a tool of development are to be enhanced by such means as investment in innovation systems. The emphasis should be on support for fora and functions that facilitate exchanges of information between the research community, the business community and society at large' (p. 2). Moreover, the objective of research capacity building in low-income countries is explicitly to be based on 'a systems oriented approach to higher education, research and innovation' (p. 3) and activities should focus on 'ensuring that research has a greater impact on the fight against poverty as a result of cooperation between universities, public authorities, the business sector and civil society' (p. 4). Hence, Sida needs to

[133] See Eklund, M. Adoption of the Innovation Systems Concept in Sweden, Acta Universitatis Upsalaensis, Uppsala Studies in Economic History 81, 2007.

[134] See, for example, Porter, M. (1990) *The Competitive Advantage of Nations* (Basingstoke: Macmillan); Porter, M. (1998) 'Clusters and the new economics of competition'. *Harvard Business Review*, November/December: 77–90.

formulate work plans to implement the strategy that reflect this systems perspective.

The bulk of support provided by Sida for innovation has so far been related to research activities and mainly, but not exclusively, to Sida's Unit for Research Cooperation (FORSKSEK). The engagement of FORSKSEK in innovation systems and cluster initiatives started with support to delegations from partners in Africa and Latin America to two international conferences on innovative clusters. In 2003 delegates from Tanzania, Uganda and Mozambique participated in The Competitiveness Institute's 6th Annual Conference on Innovative Clusters in Gothenburg, which lead the three universities to arrange the 1st Regional Conference on Innovation Systems and Innovative Clusters in Africa in Bagamoyo (Tanzania) the following year. The Bagamoyo conference was the birth of the Innovation Systems and Clusters Program for Eastern Africa (ISCP-EA) with the main objective to stimulate and facilitate the development of innovation systems and innovative clusters in East Africa. In 2004–2005 several workshops were organized within the framework of the ISCP-EA, assisted by an advisory team from The Swedish Governmental Agency for Innovation Systems (VINNOVA) and subsequently in collaboration with SICD/ Blekinge Institute of Technology. In parallel, Sida sponsored delegates from Bolivia, Honduras and Nicaragua to participate in the 2004 Global Conference on Innovative Clusters in Ottawa. In preparation for this, researchers from Chalmers University of Technology arranged workshops at universities in the three countries, a collaboration that eventually lead to the launch of the Innovative University Program (IUP) in Nicaragua in 2007. These and other innovation systems and cluster programs supported by the Unit of Research Cooperation are briefly described below.

- **ISCP – EA**: The main purpose of the program is to engage universities in stimulating, catalyzing and promoting the development of innovation systems and innovative clusters in Eastern Africa, to facilitate speedy socio-economic development and poverty reduction in the region. The program has five main components: (i) research and innovation systems policy reviews; (ii) implementation of pilot innovation systems and/or cluster initiatives; (iii) awareness creation and publications; (iv) competence building and research; (v) monitoring, coordination and follow-up forums. The program provides a framework for the national

programs, and a platform for conferences, workshops, and training. The program follows a Triple Helix methodology.
  - ISCP-Tz: A national Steering Committee has been formed for overseeing implementation of the program. Activities are centered on the College of Engineering and Technology at the University of Dar es Salaam. A first cohort of 8 and a second of 11 cluster pilot initiatives have been launched, and an additional 16 have been proposed. *(Sida contribution 2005–2009: SEK 3,560,000)*
  - ISCP-Ug: A national Steering Committee has been formed for overseeing implementation of the program. Activities are centered on the Faculty of Technology at the University of Makerere. 22 cluster pilot initiatives have been launched, 8 more have been identified. *(Sida contribution 2005–2009: SEK 3,560,000)*
  - ISCP-Mz: A national Steering Committee has been formed for overseeing implementation of the program. Activities are centered on the Faculty of Engineering at the Eduardo Mondlane University. 9 cluster pilot initiatives have been identified. *(Sida contribution 2006–2009: SEK 2,250,000)*
- **Rwanda:** During 2008 and 2009, the National University of Rwanda (NUR) worked on designing an innovation program to be included in the overall Sida support to NUR. Together with a consultant as well as involvement of a VINNOVA representative from ISCP-EA, NUR developed a proposal with a "dual approach" to innovation, comprised of an innovation process and a cluster approach. The proposal was rejected by Sida in March 2009. However, NUR was given the possibility to continue to formulate the program, for potential inclusion in a subsequent agreement with Sida. *(Sida contribution: SEK 0)*
- **IUP – Nicaragua:** The main purpose of the program is to stimulate Nicaraguan universities to engage themselves in the development of innovative clusters, in order to address the underutilization of domestic research in Nicaragua. The counterpart of the program is the National Council of Nicaraguan Universities (CNU) with 10 member universities. The program has an explicit learning approach at the level of individual researchers, yet integrated into a system of diffusion and use of research results, and follows a methodology developed by its collaboration partner, Chalmers University of Technology. *(Sida contribution 2007–2009: SEK 8,000,000)*

- **IP – Bolivia:** The Innovation Project (IP) was launched in 2007 at the University of Mayor de San Simón in Cochabamba, with the aim of creating links between university research and the local productive sector as well as between local and national governmental bodies. Two pilot cluster initiatives have started, and four other identified. A second program was initiated at the end of 2009 at the University of Mayor de San Andrés in La Paz. Here initial training has been held and one pilot cluster initiative identified. Both programs are in collaboration with VINNOVA and SIDC/Blekinge Institute of Technology, and apply a Triple Helix and production chain methodology. *(Sida contribution 2007–2010: SEK 1,260,000)*
- **Bio-Earn/Bio-Innovate:** Eastern African Program and Research Network for Biotechology, Bio-safety and Biotechnology Policy Development (Bio-Earn) was initiated in 1998 with the aim of developing capacity and competences for partner countries (Ethiopia, Kenya, Tanzania and Uganda) to effectively and efficiently use modern biotechnology in agriculture, industry and in environmental management. Today the network involves some 45 research institutions more than 80 scientist in the region. The last program (2006–2009) focused on Research for Development (R4D) and operating within nine projects, involving some 20 institutions in the region. It included a competitive Innovation Fund with the main focus on enabling bioscience innovation, technology diffusion and dissemination. Currently the successor, the Bio-resource Innovation Network for Eastern African Development (Bio-Innovate), is being set-up in collaboration with the International Livestock Research Institute in Nairobi, Kenya. The focus is on application of bio-resource innovations in the agricultural and environmental sub-sectors as means to move into higher value added production, develop agricultural markets and public-private partnerships, while enhancing adaptability to climate change. Bio-Innovate will be implemented through a Competitive Grant Scheme aimed at regional multi-disciplinary innovation projects in Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Uganda. *(Sida contribution 2006–2009: SEK 77,000,000 (of which 5,000,000 was allocated to an innovation allocation fund); 2010–2014: SEK 80,000,000)*
- **Innovation System Networks:** The Sida Unit for Research Cooperation also supports a few additional networks in various forms:

- *PACF:* The Pan African Competitiveness Forum stems from the East African Innovation activities and the collaboration with The Competitiveness Institute (TCI). A number of African researchers participated in annual TCI conferences and decided, with the moral and administrative support of TCI, to set-up a regional forum for competitiveness in Africa. A conference to launch the initiative was organized with the African Union Commission Directorate for Industry and Trade in 2008, financed by Sida and gathering 150 delegates from 20 countries. A second conference was organized in 2010. *(Sida contribution 2008–2010: SEK 3,070,000).*
- *Globelics:* Sida supports the Annual Conference of the Global Network for Economics of Learning, Innovation, and Competence Building Systems (Globelics) with travel grants from some 25 scholars from low-income countries. Globelics is a network of scholars who apply the concept of 'Learning, Innovation, and Competence Building System' (Lics) as their analytical framework; it is especially dedicated to the strengthening of Lics in countries in the South. *(Sida contribution 2006–2009: SEK 1,200,000).*
- *UniDev*: Developing Universities – The Evolving Role of Academic Institutions in Innovation Systems and Development (or *UniDev* for short) was a research project analyzing the future role of higher education that Sida supported jointly with IDRC in 2005–2009. UniDev had 13 member countries: Uruguay, Sweden, Tanzania, China, Vietnam, Cuba, South-Africa, Russia, Germany, Brazil, Nicaragua, Latvia and Mozambique, and was coordinated by the Research Policy Insititute (RPI) at the University of Lund, Sweden. At current, Sida supports UniDev with a smaller network grant, to maintain and consolidate the network. *(Sida contribution 2005–2009: SEK 7,500,000).*

The evaluation will cover all the programs listed above.

Evaluation purpose, questions, scope and use

The main purpose of the evaluation is to generate knowledge from results of Sida support to innovation systems and cluster in its research cooperation, and to provide lessons learnt for the Unit of Research Cooperation, as well as Sida more broadly, as how to best

work with research in relation to innovation systems and cluster initiatives in the future.

The evaluation will cover the programs and networks outlined in Section 0.

Evaluation questions and scope of work

As a background to the data collection and analysis of results, a first step in the evaluation is to address the definition of innovation systems and clusters in order to reflect upon Sida's use of the terms in the programs that are included in the evaluation, as well as what a relevant definition for Sida would be. A particular emphasis should be put on clarifying the particular nature of innovation systems and clusters in the context of low income countries, and how these might benefit from research cooperation.

A second is to map out the results chain implied in these contributions, in terms of outputs, outcomes and impacts.

- What direct outputs (i.e. results within the control of the programs) were expected by the programs, and what output areas (e.g. entrepreneurship, university or research infrastructure reform, policy etc.) do these outputs sort under?
- What outcomes (i.e. result necessary to achieve the desired impact, but outside the control of the program) were the outputs assumed to contribute to, and how? Through what linkages were they supposed to contribute to the impact of the program, and what were the channels of influence of the program on these linkages?
- What factors were assumed to help or hinder the programs?

Identification of results of the programs supported by the Unit for Research Cooperation will form the basis for the questions and recommendations of a more strategic nature that are expected of the evaluation. A non-exclusive list of questions to ask in order to draw lessons from the contributions includes:

- How has the Unit worked with innovation systems and clusters so far? What methods/modalities have been used? Have other departments within Sida worked with innovation systems and clusters, and are the main differences/similarities?
- What has the purpose of the programs been?
- What hypotheses are the programs built on?
- What are the results? What can be learnt from previous program evaluations?

- How well do the hypotheses hold up to the results?
- How contextually sensitive are the different methods used?
- Are there critical issues/phases?
- How is the right to research results and the issue of immaterial property rights treated?
- How were the preconditions and initial strategies of the programs analyzed?
- How do the programs fit into the research agendas of the universities?
- How have the programs impacted the research climate at the universities?
- Have the programs attracted interest from other research granting bodies?
- How have the program activities impacted policy debate and formulation in the respective countries?
- How do the programs relate to national/regional policies (e.g. regarding research, innovation, industry, and poverty), and have the program activities impacted policy debate and formulation in the concerned countries/regions?
- How do the programs relate to those of other donors in the concerned countries/regions?
- For Rwanda interesting questions include: Was it right to try a different approach than in the other ISCP-EA countries? How was NUR's development of the program influenced by the advocacy of a "dual approach" with partly conflicting methods? Was it a reasonable assessment by Sida not to approve of the proposal?

The list of lessons-based questions shall be further specified by the Team as part of the inception report, in order to contribute the overarching questions of a strategic nature, like the following:

- Are innovation systems and clusters useful ways of thinking about the impact and use of research in development, and the role of Sida's Unit of Research Cooperation in such support?
- How well do the concepts of innovation systems and cluster initiatives translate into approaches and ways of working with research cooperation?
- Can the approaches used so far complement one another, and if so how?
- Should any of the current approaches/ways of working be developed further, if so, which, and how should this be done?

– Are there other ways of working with research in relation to innovation systems and clusters that could be useful to the Unit for Research Cooperation, and Sida at large?
– What mechanisms within Sida are required to successfully support programs based on systems of innovations and cluster approaches? Are such mechanisms in place? What are the supporting and hindering factors?
– Who are the main donors or international funding agencies that focus on innovation systems and cluster initiatives? Have they conducted evaluations or communicated results and lessons learnt in terms of ways of working of interest to Sida?

Use of the evaluation

The main users of the evaluation will be the Unit for Research Cooperation (FORSKSEK) and other concerned departments at Sida, as well as the donor agencies with a shared interest in learning more about how to work with and address issues regarding innovation systems and cluster development. A seminar with involved parties will be held at Sida to present the results of the evaluation. The results will also be disseminated and discussed at various fora in Stockholm as well as internationally, for example, in connection with relevant conferences or network meetings.

Approach and methodology

The evaluation process will be as open and transparent as possible to enhance participation of all evaluation partners involved. It will be governed by a Management Group (MG) and a Reference Group (RG), where the MG has the deciding mandate over the evaluation and the RG takes an advising role. In addition representatives from Sida's partners will form a Consultation Group (CG), and take a quality assurance role.

The evaluation process, including methods and reporting, shall adhere to the OECD DAC *Evaluation Quality Standards*. Key definitions used (e.g. regarding outcomes, impact, sustainability and attribution) shall follow *DACs Glossary of Key Terms in Evaluation and Results Based Management*.[135] The evaluation report will be assessed based on these standards and definitions. The report must follow the format for Sida evaluations (see Appendix 1).

[135] Both guidelines are found on the web-page of the OECD DACs Evaluation Network (www.oecd.org/dac/evaluationnetwork).

Building on the program logic and questions outlined in section 0, the evaluation shall identify how the programs supported by the Unit for Research Cooperation have contributed to the formation of innovation systems and innovative clusters, and thereby the use of research in society and closer collaboration between, universities, governmental agencies, business community and civil society. This includes estimating the value added of the participation in the programs not only from the viewpoint of researchers and universities, but also the other stake holders. Although it may be complicated to estimate specifically the level of attribution the Sida support, there should at least be a discussion on how the Swedish assistance has contributed to various outcomes and impacts.

The evaluation shall be conducted according to the different phases outlined in section 0.

Evaluation phases

The evaluation shall be conducted in four main phases:

Phase I – Mapping, methodology and inception report

The purpose of phase I is to map Sida's support to innovation systems and innovative clusters, as well as other donors and research funders that are engaged in similar initiatives (at a general level), in order to discuss the conceptualizations used and to further specify the evaluation questions and methodology. The inception phase will encompass a total of three person weeks of work.

During the inception phase the Team will collect and review relevant information concerning Sida's support to innovation systems and innovative clusters. The main focus and detailed analysis will be put on the contributions in the portfolio of the Unit for Research Cooperation, but a general overview of similar or related support from other department at Sida is required. An overview of the main actors (donors and funding agencies) involved in innovation systems and clusters initiatives as modalities and ways of working in development cooperation, is also required, as well as identification of evaluations conducted by other parties with relevance to this one. The Team will develop further the evaluation questions and suggest a methodology for the evaluation that not only adheres to the OECD DAC *Evaluation Quality Standards* and follow *DACs Glossary of Key Terms in Evaluation and Results Based Management* as discussed above, but also puts achieved results in relation to the overall development of the concerned industries in their respective countries, as

well as address the issues of attribution of results to participation in the programs that are being evaluated.

The phase should result in an inception report which will be presented and discussed with the MG, as well as commented on by the RG and CG. The Team Leader has one week to revise the draft, after which the MG will decide on the inception report in order to guide the evaluation phases that follow. It should include the following:

- A results chain model of the program to be covered in the evaluation outlining expected results at the outcome and impact levels and the logical linkages between expected outputs, outcomes and contribution to broader impacts;
- An elaboration of the evaluation scope and question defined in this ToR, and a discussion on evaluability, i.e. on likely opportunities and obstacles to answering to the evaluation questions;
- Suggestions for applying and prioritizing between evaluation criteria (relevance, efficiency, effectiveness, impact and sustainability);
- A well elaborated evaluation approach and methodology, including specifications and justification of the evaluation design and methods for data collection and analysis as judged appropriate to answer to the evaluation questions; and, if applicable, selection of relevant case studies in the field.

The inception report must be accepted by the MG in order for the evaluation team to continue and carry on with the rest of the assignment. If the inception report does not fulfill the requirements of this ToR, the MG has the right to contract a different team to carry out the assignment.

Phase II – Data collection, writing of individual case reports

The purpose of phase II is to collect and analyze field data in order to draw lessons from Sida's support to innovation systems and innovative clusters within its research cooperation, concerning results as well as modalities/work methods used. A total of eight person weeks of work is estimated for this phase.

During phase II, the Team-consultants will collect and analyze quantitative and qualitative data in Uganda, Mozambique, Tanzania, Kenya (three person weeks) and in Nicaragua and Bolivia (two person weeks). A survey to Sida supported research networks within innovation systems and innovative cluster will also be completed

(two person weeks). The survey study does not require travel. The Team Leader will have a monitoring and supporting role during the field phase (one person week), at a distance.

Phase II will result in one report by each team-consultant, presenting the findings of each. The estimated work time includes collecting and analyzing data, *and* finalizing individual reports.

Phase III – Writing of final report, presentation of draft

The purpose of phase III is to, based on the inception report, the mapping in phase I and lessons identified in phase II, draw conclusions about the results and modalities used so far and to give recommendations as to how Sida best should work with innovation systems and innovative clusters in the future, with a particular focus on its research cooperation. A total of two person weeks of work is estimated for phase III.

During phase III the Team Leader will, with support from the team-consultants, analyze the individual reports from phase II, guided by the evaluation questions and methodology formulated in the inception report, and synthesize the findings into a draft evaluation report. The draft shall be written in English in a logical and accessible format, with clear linkages between analysis, conclusions and recommendations, and with main conclusions and recommendations presented in an executive summary. The draft evaluation report shall be presented to the MG and commented on by the RG and CG in order to discuss the validity and relevance of findings, conclusions and recommendations. The draft evaluation report will be assessed by Sida according to the OECD DAC *Evaluation Quality Standards* and the degree to which it meets the overall purpose of the evaluation as well as the questions, methodology and intent of the inception report.

The draft evaluation report shall be revised according to the comments received. The Team Leader has two weeks to revise the report, and to collect additional data if needed.

Phase IV – Presentation and dissemination of evaluation findings

During the fourth phase the evaluation team shall present the draft final report for discussion on conclusions and recommendations to be validated, developed and fed into the final report. The final report will be presented at various fora, including seminars and smaller focused meetings at Sida and elsewhere. Evaluation findings should also be presented at international conferences or network

meetings. A round table discussion with concerned stakeholders may potentially be arranged to discuss findings and lessons learnt.

Timing, reporting and deliverables

Progress and results shall be reported through written reports and oral presentations. The inception report shall not exceed 25 pages and the evaluation report shall not exceed 50 pages, excluding appendices.

Deliverables and reporting as outlined in Section 0 shall be guided by the following time plan:

	Activity/deliverables	Timing/date
I	Drafting of Inception report	September 2010
	Submission of draft inception report (to MG, RG and CG)	September 24, 2010
	Presentation of draft inception report to MG	October 1, 2010
	Final, revised and agreed inception report (1 week after MG meeting)	October 8, 2010
II	Data collection and analysis, writing of summaries	October–November 2010
III	Drafting of final report	Nov, 2010
	Submission of draft final report (to MG, RG and CG)	December 1, 2010
	Presentation of draft final report to MG	December 8, 2010
	Final, revised and agreed report (2 weeks after MG meeting)	December 22, 2010

Budget

On the basis of the methodology and work plan outlined in Sections 0 and 0, it is estimated that the Team will provide about 11 person weeks of services. The total cost (fees and reimbursable) must not exceed SEK 750 000. The budget must clearly indicate the costs for each of the evaluation phases.

The Team-leader is responsible for ensuring that the final evaluation report in English is language edited. This shall be accounted for in the budget.

Evaluation team and qualifications

The Team-leader is responsible for constituting a team of relevant expertise for the whole evaluation process, either including staff with profound knowledge of innovation systems and clusters as well as

deep contextual knowledge and language skills needed to carry out local interviews and surveys, or with a plan for contracting team-members with this competence.

The tender must provide a clear plan for both adequate staffing and for carrying out the assignment. The tender must also provide a detailed account of understanding of and the approach to innovation systems and clusters that the Team Leader and the proposed team will take, in addition to a suitable methodology (including delimitations and description of quantitative and qualitative methods to be used). A detailed proposed work plan according to the phases outlined in Section 0 and a detailed budget must also be suggested in the tender.

The team as a whole shall have the following qualifications:

- Documented expertise in the discipline of innovation systems and/or clusters and regional development, with a focus on the role of research in such systems.
- A solid understanding of knowledge creation processes in low income countries, and the role of research and innovation in emerging systems of innovation and clusters in such contexts.
- Expertise in qualitative methods (including survey design) and quantitative methods, particularly in low income countries.
- Experience from international cooperation.
- Knowledge and experience of Results Based Management.
- Knowledge of Sida and its policies, strategies and methods for research support, as well as those related to innovation within Sida at large.
- A profound knowledge of the contexts of southern and eastern Africa, Nicaragua and Bolivia, preferably including professionals based in the region.
- Fluency in English and Spanish.

Organization and management

The Management Group (MG) is responsible for all major decisions regarding the evaluation. Members in this group are departments within Sida that have financed the programs subject to evaluation, or that have a particular interest in innovation systems and clusters as a potential method for development cooperation. To strengthen the relevance of the evolution, consultation is required with other relevant partners, such as organizations engaged in research or funding of innovation systems approaches or cluster initiatives. These will be represented in the evaluation's Reference Group (RG).

To enhance the reliability of the evaluation, a Consultation Group (CG) of representatives from the various programs will also be formed. The division of responsibilities between the groups is clarified below:

Management Group

The Management Group (MG) for the evaluation will consist of representatives from Sida's Unit for Research Cooperation (FORSKSEK), the Unit for Evaluation (UTV), the Department for Economic Opportunities (ECOP), the Department for Development Partnerships (AKTSAM), and the Department for Knowledge, Health and Social Development (HoK). It is estimated that the MG will meet 3–4 times during the evaluation process. The group has the following mandate and responsibilities:

- Coordination, calling and chairing meetings; dealing with practical management issues.
- Ensuring the quality and relevance of the evaluation, by commenting on the ToR, the inception report and draft reports, and through timely consultation with the CR group linked to the evaluation.
- Taking major decisions concerning the evaluation, with regards to ToR and draft reports.
- Promoting the use of the evaluation, e.g by organizing seminars, and disseminating the evaluation through various channels, such as web-sights, sector/donor meetings, etc.

FORSKSEK is financing the evaluation and will chair the MG and be responsible for practical managerial issues (e.g. calling to meetings, collecting comments on drafts). After all MG members have commented and agreed upon the ToR, the full responsibility of coordinating the procurement and contracting of the evaluation team will be delegated to FORSKSEK. FORSKSEK will also be responsible for maintaining regular contact with the evaluation team leader, and for some initial guidance as to how to identify other qualified team-members. The team leader shall report to FORSKSEK on the progress of the evaluation and guide the rest of the evaluation team.

Reference Group

The Reference Group (RG) for the evaluation will include relevant organizations that either fund or conduct research on innovation,

innovation systems and clusters in various contexts – or that have a particular interest in these fields and that are important as potential collaboration partners to Sida. In this spirit, the RG will include representatives from VINNOVA, OECD, UNESCO, UNU-MERIT. It will also include a representative for the Policy Specialist at FORSKSEK that handle the Sida contributions that are being evaluated.

It is estimated that the RG will be engaged 3–4 times during the evaluation process. The group will be coordinated by the MG, which will ask for advice at about 3 points in time (on ToR, inception report, and draft evaluation report). The RG will not be responsible for taking any decisions with regard to the evaluation or handling any practical matters, but will play a strategic role by accomplishing the following tasks:

- Ensure the quality and relevance of the evaluation by providing comments and advise in a timely manner at important check points in the evaluation process (notably with regard to the ToR, the inception report, and the draft evaluation report).
- Enhancing the dissemination and use of the evaluation results.

Consultation group

The Consultation Group (CG) of the evaluation will include representatives from partner organizations within the Sida contributions that are being evaluated. It is estimated that the CG will be engaged 3–4 times during the evaluation process. The group will be coordinated by the MG, which will ask for advice at about 3 points in time (on ToR, inception report, and draft evaluation report). The CG will not take any decisions with regard to the evaluation or handling any practical matters, but will play a quality assurance role by accomplishing the following tasks:

- Ensure the quality and factual accuracy of the evaluation by providing comments in a timely manner at important check points in the evaluation process (notably with regard to the ToR, the inception report, and the draft evaluation report), to prevent that misunderstandings or significant errors influence the analysis and recommendations of the evaluation
- Enhancing the dissemination and use of the evaluation results.

Evaluation of Sida's Support to Innovation Systems and Clusters, a Research Cooperation Initiative

Main report

This evaluation report provides an overview of ten programs in the areas of Innovation Systems and Cluster initiatives supported by Sida's Unit for Research Cooperation. The evaluation was commissioned with the objective to draw strategic knowledge from the innovation programs supported by Sida. The evaluation assesses the portfolio as a collection of "ways of working" within scientific research cooperation programs.

The report highlights that support and investment in Innovation Systems can be excellent means for encouraging the use of research as a tool for development. The report was carried out by an independent evaluation team, and it is presented in two volumes; a Main Report, which focuses on the portfolio in general, and a Collection of Individual Cases, which contains more detailed information.

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