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Pitfalls and Opportunities in Knowledge Sharing
Experiences from a research capacity building project in Central America

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What Makes a Gatekeeper? Insights from the Finnish Nano-Community

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Abstract:

A number of attempts have been made in the North to assist in the formation of independent research capacities in the South by establishing knowledge sharing through North-South research collaboration. One such attempt was initiated by Danida through its programme for Enhancement of Research Capacity (ENRECA).

Aalborg University was approached by the National University of Costa Rica to make a joint research venture within the field of sustainable development. The project got a Central American (CA) regional perspective by including participants from Nicaragua and El Salvador. The project was titled Sustainable Development Strategies for Central America (SUDESCA) and aimed at support of relevant CA research activities, including the formation of adequate organizational setups that would eventually sustain forthwith. The project focused on two theoretical themes, i.e. the National Systems of Innovation and the Social Construction of Technology approaches.

In this paper the CA universities are viewed as important sub-systems of the respective national systems of innovation. Thus, the following is an analysis of the institutional sustainability of the research capacity of universities perceived as parts of the national systems of innovation. To what extent did the knowledge transfer and exchange as well as the organizational capacity building efforts succeed? What were the main pitfalls and opportunities experienced? What did the Aalborg team learn about its own research capacity set-up?

Our overall conclusion is that it is a mistake to assume that research capacity may be more or less directly transferred from the North to the South. Research capacity existing in the North has to be carefully adapted to the specific conditions where it may be expected to be useful.



Key words: Innovation system, knowledge adaption, Central America

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1. Introduction

Over the past three decades it became more and more apparent that what Basalla (1967) call the “dependent colonial scientist” is not capable of providing adequate insight and knowledge about the development processes in the South. Sagasti (2004:1) elaborates this: “The colonial scientist is dependent in the sense that the sources of his education and training, the origin of the scientific traditions that he adheres to, the orientation of his activities and the ways of obtaining recognition for his work, are all defined in the metropolitan scientific power and not in the country or region in which he lives and works”.

Realising this, increasing efforts were made in the North to assist in the formation of independent development research capacities in the South. Thus, attempts to establish knowledge sharing through North-South research collaboration were made by a number of development assistance agencies (Haddad 2006; Bradley 2006). One such attempt was initiated by the Danish International Development Agency (DANIDA) in 1989 by establishing a programme for Enhancement of Research Capacity (ENRECA) (ITAD 2000).

Shortly after, Aalborg University was approached by the National University of Costa Rica with a proposal to make a joint research venture within the field of sustainable development. The project design that emerged from mutual discussions eventually got a Central American (CA) regional perspective by including the national universities of both Nicaragua and El Salvador as well as an NGO research organisation in El Salvador. The project was approved for ENRECA funding in 1996 and titled Sustainable Development Strategies for Central America (SUDESCA).¹

The normative assumption of the SUDESCA project was that enhancement of selected CA universities’ research capacities could be instrumental for sustainable development strategy formulations. SUDESCA, thus, started out with the objective to improve and strengthen the research capacity in the CA universities in question, especially the research capacity related to sustainable development in small countries in CA. This

¹ The SUCESCA team members were as follows: **Costa Rica:** Centro Internacional de Política Económica para el Desarrollo Sostenible (CINPE), Universidad Nacional. **Nicaragua:** Escuela de Economía Agrícola (ESECA), Universidad Nacional Autónoma. **El Salvador:** Escuela de Economía, Universidad de El Salvador. And Fundación Nacional para Desarrollo (FUNDE). **Denmark:** The IKE group (Innovation, Knowledge and Economic dynamics) and the Centre for Environment and Development (CED), Aalborg University (AAU).

implied knowledge transfer for augmentation of their research activities and for the formation of adequate organisational setups, especially research cooperation routines that would eventually sustain after the withdrawal of the ENRECA funding.

The overall problem addressed by the project was that the CA economies are exposed to both increased international competition and rapidly changing patterns of international specialisation. This implies the risk that the region would be locked-in to a low income and resource degrading future, and more specifically, that the CA countries would in effect maintain a weak research and development capacity, with few opportunities of entering a good circle of mutually reinforcing social, economic and environmental development.

Although the conception of sustainable development has been discussed and pursued for about a quarter of a century, it is still contested from all corners of the world in general and from university research and teaching practices in particular. To face this challenge, the Aalborg University team members of SUDESCA have attempted to merge two theoretical approaches, i.e. the National Systems of Innovation (NSI) and the Social Construction of Technology (SCOT) approach. Thus, efforts have been made towards formation of a joint interdisciplinary research capacity that is directed towards understanding what sustainable development entails, however primarily within the European setting of the North.

In practical terms, the SUCESCA project was conceived as an opportunity for the CA research team members to be acquainted with innovation and technology research tools; for the Aalborg team it was an opportunity to broaden its research outlook towards developments in the South.

In the SUDESCA project the Central American universities are viewed as important sub-systems of the respective national systems of innovation. Thus, the following is an analysis of the institutional sustainability of the research capacity of the universities perceived as parts of the national systems of innovation. Furthermore, the SUDESCA projects itself becomes a part of the systems of innovation we are analysing. This means that to some extent we, so to speak, are studying ourselves doing capacity enhancement.

To what extent did the knowledge transfer and exchange as well as the organisational capacity building efforts succeed? What were the main pitfalls and opportunities experienced? What did the Aalborg team learn about its own research capacity set-up? These are the main questions discussed in this paper.

2. Background

Elements of a comparative description of the 4 countries

It soon became evident that the CA regional perspective selected for the project turned out to be an interesting, but intricate challenge. Interesting, because it offered a valuable opportunity to appreciate and compare important determining factors of how research capacity is socio-politically entrenched. Intricate, because the existing disparities between the capacities of the participating research organizations turned out to encumber the planned progression of the project.

In some respects the 4 countries (Costa Rica, El Salvador, Nicaragua and Denmark) are similar to each other. They are all small and culturally rather homogenous countries². However, the population of Denmark is older and has a much lower growth rate than the Central American countries.³

On the other hand, standard macro-economic indicators show a number of disparities between the countries. There are, for example, big differences in income and income distribution with Costa Rica taking up a position between Denmark on the one hand and Nicaragua and El Salvador on the other. At the same time all countries are in relatively balanced macro-economic situations. However, it also belongs to the picture that both El Salvador and Nicaragua has high underemployment rates, and that all three Central American countries have persistent current account deficits (CIA. 2006).

Furthermore, the composition of both the labour force and the total production is significantly different. The share of agriculture in total production is lower in Denmark while the share of services is higher as expected. When it comes to export shares both Denmark and Costa Rica have relatively high shares (43% and 47%) while El Salvador and Nicaragua have less open economies (27% and 24%).

Development indicators, such as the HDI rankings, also support the picture of Costa Rica positioned in between Denmark on the one hand and El Salvador and Nicaragua on the other hand, the rankings being 14 for Denmark, 47 for Costa Rica, 104 for El

² There are some indigenous and other minorities in the Central American countries. These are small in Costa Rica (1% Amerindians and 5% black) and El Salvador (1% Amerindians) and somewhat more significant in Nicaragua (5% Amerindians and 9% black).

³ The median age in 2006 is almost 40 years in Denmark and about 21, 22 and 26 years, respectively, in Nicaragua, El Salvador and Costa Rica.

Salvador and 112 for Nicaragua (UNDP 2004). The diffusion of communication technologies in the Central American countries as measured by the number of mobile telephones and internet users also lags behind Denmark in about the same way as other development indicators (CIA 2006).

Even if the socio-economic situation is rather similar in the three Central American countries their political backgrounds are quite different. Costa Rica has a peaceful recent history of democratic development with substantial investments in health, education and social security. The level of social conflicts has been low and there has been considerable political stability, at least until recently.

The situations in El Salvador and Nicaragua are different. In El Salvador a 12 year long very violent civil war ended in 1992. And In Nicaragua there was civil war in the late 1970s and most of the 1980s characterized by armed internal conflicts between the Sandinist government and a US supported insurgency. Most observers agree that this has hampered development in the two countries most severely. Social capital has been eroded and political instability remains high. In addition to this, El Salvador and Nicaragua are more plagued by hurricanes and earthquakes than Costa Rica and, not to be mentioned, Denmark.

This is not the place to conduct a serious comparison of the history and present situation of development in the four countries. The intention here is only to hint at some similarities and differences, which may make the issue of knowledge transfer both achievable and consequential.

To illustrate this issue some direct indicators of the research capacity would be useful. Table 1 shows some, admittedly very rough, indicators. It hints at strikingly large differences between the 4 countries with approximately the same ranking as for most of the indicators already mentioned. We may, cautiously, conclude that at least some preconditions for knowledge transfer between the 4 countries are present: El Salvador and Nicaragua ranks low on the HDI index but still seem to have some basic elements of education- and R&D infrastructure. Denmark has a well developed “knowledge-based” economy and Costa Rica is strategically placed in the middle, i.e. with a relatively similar distance to both ends of the scale. Later in this article we will make some reflections on more intangible issues related to research capacities such as trust, norms of interaction and networking abilities.

Table 1: Education, R&D, and patent indicators.

Country	Education, % of GDP (2002)	Tertiary education, % of total public spending on education	Patents granted to residents per million of people (2002)	R&D, % of GDP (2002)	Total number of researchers (1990-2003)
Denmark	8,5	32,0	90	2,5	4822
Costa Rica	5,1	18,8	0	0,4	533
El Salvador	2,9	6,6	47
Nicaragua	3,1	37,7	0	0,1	73

Source: UNDP. 2004. *Human Development Report*. New York: United Nations Development Programme. (Country Fact-sheets.) This source is available at: <http://hdr.undp.org/statistics/>

Note: The statistics recorded here are only showing the magnitudes within the formal economy. In both El Salvador and Nicaragua the informal economies are of sizable magnitudes; several of the economic indicators are thus not very precise.

The funding agency ENRECA

As already indicated, the SUDESCA project was financed by DANIDA's ENRECA programme. This dates back to 1989 as an attempt to move away from the predominant "one-direction" (i.e. the North teaching the South) development research by Danish academicians towards promoting mutual North-South learning through collaborative research. Apart from the primary aim of enhancing research capacity in receiving developing countries, it also specifically aimed at building up the Danish research organizations interested in working in developing countries, and increasing their capacity to do so (ITAD 2000).

In the mid 1990'ies DANIDA changed its development assistance approach from project to sector programme support focusing on specific sectors like agriculture, infrastructure and environment. At the same time ENRECA projects were encouraged to

link their research themes towards generation and dissemination of knowledge that would be relevant for the sector programmes in the selected countries.

The general approach of the SUDESCA project

The SUDESCA project had a two-tiered approach. One tier was the ideas about learning-by-doing-research and learning-by-networking, i.e. learning (including research) as an interactive, social process. The other tier was individual human capital building i.e. enhancing the capabilities of individual researchers by scholarships, conference participation, production of reports, etc.

Using the systems of innovation approach implies regarding research capacity as part of the endogenous scientific and technological base as defined by Sagasti (2004). It also implies the idea of building and promoting innovation systems as part of a development strategy and as a response to globalization and increasing international competition. This included a focus on interactive learning, innovation and competence building.

The following outlines the major goals and activities of the SUDESCA project.

Problems and objectives

The main development problem addressed was the prevalence and dominance of unsustainable development strategies in the Central American region, combined with a weak research capacity to cope with this problem.

The development objective of the project was to improve the formulation and implementation of environmentally, socially and economically sustainable development strategies for Central American countries.

Below this over-all level a more immediate objective was formulated: To enhance the research capacity of the four participating research organisations in Central America. More specifically the objectives were:

1. To contribute to an interdisciplinary understanding of the relations between sustainability on the one hand and the anatomy and change of national, regional and local systems of innovation on the other hand;

2. To integrate research on institutions and institutional change with research on innovation processes including research on cleaner technology and environmental management;
3. To support the development of viable research agendas at the participating organisations, including an action oriented research strategy allowing interactive learning with firms, business associations, public policy makers and other social actors.
4. To contribute to the development of research based education at the university level.

Main activities

The SUDESCA project included the following programs and activities:

a. Joint research program

Within the conceptual framework of national systems of innovation, the program focused on investigations of competitiveness and sustainability within 4 research themes: (i) organisation and management of firms, (ii) interaction between firms leading to innovations, (iii) formal and informal knowledge infrastructures, and (iv) specialisation patterns of the economy.

b. Education and training program

Apart from a PhD program for selected CA project participants at Aalborg University, the project intended to contribute to the development of a Central American PhD program about sustainable development in Costa Rica. In Nicaragua and El Salvador, the aim was to develop existing graduate programs into post-graduate or master programmes.

c. Dissemination and administrative support

One element of the dissemination activity was a SUDESCA Research Paper Series published in both English and Spanish. Another element was regional workshops and international seminars rotating between the participating countries. In this way it was hoped to institutionalize a forum for recurrent dialogue with public and private policy makers and stakeholders.

All three activities motivated improved organisational and administrative procedures at the participating organizations.

The SUDESCA project was financed in two consecutive phases of 3 years duration each and a “phasing-out” project. It closed at the ends of 2006.

3. Conceptual framework

Basic notions behind the project design

As indicated in the introduction, the normative assumption of the SUDESCA project was that enhancement of selected CA universities’ research capacity could be instrumental for sustainable development strategy formulations.

An underlying supposition is that sustainable development includes the formation of an endogenous science and technology base, defined as “the set of usually well developed and closely interrelated scientific, technological and production capabilities that foster innovation and make it possible to provide goods and services in an efficient manner”. This means that sustainable development can not rely exclusively on exogenous knowledge elements “...which are seldom related to the stock of traditional knowledge, techniques and production in the country, which have relatively stronger ties with their counterparts in the developed countries, and which do not foster innovation or efficient production” (Sagasti, 2004:8). The assumption is that endogenous and exogenous elements have to “work together” and support each other mutually in any effective development strategy.

As already mentioned the SUDESCA project tried to rely on a combination of ideas from the NSI and the SCOT approaches. This is not the place to discuss the characteristics of these approaches or the degree to which they may complement each other (Edquist 2005, Müller 2003). Instead we will very briefly formulate some of the basic theoretical assumptions behind the project that are based on these two approaches.

We use a broad notion of technology including knowledge about processes, techniques, products and organization. Technology and technological change are seen as rooted in society and inescapably affected by different aspects of the globalization process. Understanding technological change implies a focus on the relations between technical and social change, often expressed as the relations between technological and institutional change.

We regard different processes of learning and innovation as basic drivers of development. Doing so implies a specific focus on the relations and interactions between different organizations, firms and groups of people including the relations between collective and individual action and between public and private actors.

It is included in our notion of technology that it has built-in tendencies to change, often in unexpected ways and directions. The tendency to change is constituted in the dominating value system and basic institutions of the particular society in question. Technology changes over time and from social formation to social formation. This is also to say that technology is *socially* constructed. The quest for endogenous technology development is thus to a large extent affected by the national systems of innovation.

The concept of cleaner technology that was introduced in the SUDESCA research agenda builds on this holistic approach. It primarily relates to the notion of environmental sustainability, but without also being socially or economic sustainable it would of course not be effective. Cleaner technology is, thus, a relative and locally embedded concept.

Knowledge transfer

Knowledge and transfer of knowledge between countries is increasingly regarded as key factors in development in mainstream economics. This is evident in for example several publications from the World Bank (World Bank 1999, 2002). This insight about the importance of knowledge is, of course, not very new. For example, ever since the discovery of Solow's residual, improved technological and organizational knowledge in a broad sense has been regarded as the main explanation of economic growth (Abramowitz 1956, Solow 1957).

The transfer of knowledge between countries has often been looked upon as an important vehicle of growth. This is for example the case in the theory of so-called catch-up growth. According to this theory the fast growth of many OECD countries during the 1950's and 1960's was explained as a catching-up process in which many countries imported and applied more advanced technologies from the US. From this approach it is only a small step to looking upon development of low-income countries as generally depending on transfer of different kinds of knowledge from high-income countries. Development is seen as a process of creation and utilization of new

knowledge. Knowledge transferred from abroad and then adapted, diffused and utilized is regarded as an important part of this. In this way development becomes a process of learning and competence building fitting very well into an evolutionary theoretical framework.

Even if this approach is very useful it is important, however, not to regard knowledge as *the* crucial or *the* most important factor and learning to be *the* decisive process in development. It may be just as reasonable to appoint social capital or nutrition and health to be the most important factor and education and health-care to be the most important process. There are several important development factors and the importance of each one of them may change over time and space. It is crucial, however, to take into account that the development factors depend and feed upon each other. The effect of a single specific factor can't be isolated and calculated since the factors work together.

A program like ENRECA is a rather clear-cut application of the idea that knowledge can be transferred from one country to another and that this may play an important role in the development process. The knowledge that the program intended to transfer (i.e. the knowledge about how to do and organize research) is certainly both complex and fragile, but the program was clearly built on the assumption that at least to some extent it is possible, not only to move such knowledge between countries, but also that this can be deliberately organized through specialized development aid projects.

We do not intend to question that assumption in this paper. It has proved to be valid in many cases. More modestly, we want to discuss some of the many difficulties and traps, as well as some of the more successful experiences in research capacity enhancement through knowledge transfer that we have encountered in our own project.

The notion of research capacity

Any deliberate effort to enhance the 'research capability' of a person or the 'research capacity' of a group, organization or country would benefit from a reasonably clear definition of these notions. This is certainly also the case for a project within a development aid program, which aims at improving the research capacity of developing countries. The big difference in this respect between the donor country and the host country, which is a basic assumption behind the starting of such a project at all, makes it crucial to have a clear idea of what it is all about. What do we mean by research capacity? How can it be characterized in this context?

The concept is multifaceted and context dependent in the sense that the concrete meaning of a “good research capacity” is different from country to country. It is far from certain that enhancing research capacity means the same thing and points at the same measures in the donor country and the receiving country.

However, conceptual complexity is not an argument for conceptual sloppiness. A discussion of the notion of research capacity will reveal and pinpoint its different dimensions and make it easier to see how concrete improvements might be achieved. There are different ways to look at research capacity, which, without necessarily being in contradiction with each other, focus on different aspects.

One way is to focus on research capacity as *a process* rather than *a position or state of affairs*. Like anything connected to knowledge, research capacities are never in equilibrium. They always change. For example, the very process of research leads to new information, experience and insight and this will, invariably, change the research capabilities, which were utilized in the first place. Furthermore, research capacities, which lie idle, will deteriorate.

It is reasonable to think of research capacity as a partly cumulative process. Thulstrup (1996) defines three stages (or levels) in research capacity building: *Partial research capacity* has been reached in a given field when a research group is able to perform research at an international level, provided the necessary physical facilities and access to assistance from competent co-operative partners are available. *Complete research capacity* characterizes a situation where the researchers are independently performing all aspects of research in the field, including procurement and maintenance of physical facilities, training of young researchers, completion and dissemination of research projects, as well as other managerial tasks. *National research capacity*, finally, includes i.a. the capability to prioritize and efficiently support research activities, to monitor and evaluate these, to attract and keep qualified researchers in the country, and to apply the research outcomes - both in the form of research results and training - to the benefit of national development.

Thulstrup concludes his presentation by saying that "many supply driven programs (those designed by donor or lender organizations on their own) for research capacity building in developing countries aim primarily at the first level. Standing alone, this is not likely to lead to sustainable capacity building". (Thulstrup 1996: 83). It goes without

saying that a process oriented view does not imply that the process is necessarily progressing from less to more or better research capacity, neither relatively nor absolutely.

Also without a process-oriented view it is possible to distinguish between capacities at different levels. There are different kinds of research and there are considerable overlaps and fuzzy borders between research and other activities connected to technological change. For example in the theory of economic growth there is both formal theory (predominantly using mathematical language and formal model building) and appreciative theory (theories with less formal structure analyzing and systematizing historical and empirical observations of growth and structural change) (Nelson and Winther 1982). There is also historical research on different levels of aggregation about technological and institutional change regarded as drivers of economic growth.

Research capacities may be concentrated on one or more of such theoretical “levels” even if there can be made a positive argument against isolating them from each other. Furthermore, “applied” research into the causes of economic growth is going on in the R&D departments of firms, in relation to R&D cooperation between firms and even in less organized forms of technical problem solving in and between firms with or without R&D departments. This means that there is a whole spectrum of different kinds of research or research related activities from pure, theoretical, basic research at universities to minor improvements of products and processes in firms. The point is that the research capacities of a country may be concentrated in a few fields in a small number of university departments or spread out over a large number of research types and areas situated in many organizations and firms. Research capacities may be *concentrated or dispersed*.

It is also important to notice that there are close relations and significant overlaps between research, education, especially higher education, and application of research results. In addition there are many feedbacks and interactions between these activities. Research based education is the main tool by which universities spread new knowledge and research results to the rest of society. The application of new knowledge to problem solving in production processes in firms, often by the help of new bachelors, masters and PhDs from universities, provides universities and research institutes with information and feed-backs, which are crucial for their further research. For such reasons the development of research capacity depends very much on both education and

concrete application of research results. You may say that *research capacity can be looked upon both in a broad and in a narrow way*. Any serious effort to enhance research capacity has to take this in to account.

It may also be useful to observe that research capacity can refer to individual researchers as well as to groups of researchers. It is for example possible to make a descriptive distinction between capabilities connected to individual human capital or individual human resources in terms of what kind of research the individual researcher is capable of doing on the one hand, and capacities connected to networks of researchers and research organizations, including synergies following from different kinds of interaction on the other hand. Often, but not always, the individual capabilities and organizational capacities support each other. This distinction between *individual capabilities and collective research capacity* does not exclude the distinction between partial, complete and national capacities. All stages in the process include both types of research capacity. It is important to note, however, that if the capabilities of individual researchers are not brought to feed upon each other in networks and research organizations their potential productivity effects will not be realized and they will not be sustained. Institutionalization of individual capabilities into collective capabilities is a key element in capacity building.

Finally, there is an important distinction and connection between *research capabilities/capacities and research opportunities* to take on-board in this conceptual discussion. Opportunities have to exist and they have to be utilized if you want to sustain the capacities already created. Young people educated in science and/or technology have to be able to get research related employment at universities or R&D departments of private firms. Research organizations have to be able to get continued funding. Networks must have resources for repeated interaction and cooperation. If governments do not support research enough and if firms do not invest sufficiently in technical and organizational development, research capacities will be eroded and money spent on education and research infrastructures wasted.

Summing up, we have made several distinctions in the notion of research capacity. We have differentiated between research capacity as a process and a state or position; between concentrated and dispersed capacity; between research capacity in a broad and narrow sense; between individual capabilities and collective research capacity; and

finally between research capacities and opportunities. These distinctions (and you might think of more) illustrate the complex and multifaceted character of the concept.

4. Outcomes of the SUDESCA project

In order to discuss the positive and negative experiences of knowledge transfer through the SUDESCA project we begin by shortly summing up the results of our efforts throughout the project. A list of what has been considered as results, positive and negative, is at the same time an indirect indicator of the values and aims, which explicitly and implicitly have guided the project. The list includes things, which have been clear from the beginning and figure in the written project descriptions and applications for funding, like education of PhDs and production of reports. It also includes things, which have evolved during the project, like the development of a learning and innovation centred approach to development issues in general and spin-offs in terms of other projects.

The more or less palpable results include the following main issues:

a. Joint research

- The project was implemented by semi-autonomous research task groups from the participating research organisations, including the PhD students. Each group had 2-3 members and did address particular cross-cutting interdisciplinary research issues which were presented in a series of working papers.
- The project organized frequent joint internal workshops, as well as seminars and conferences in Central America with external stakeholder participation, e.g. related research groups, government and civil service organisations as well as local NGOs.
- Project members participated in numerous workshops and conferences in different countries, including Denmark, thereby ensuring network building, connecting researchers in Central America to regional and international research communities.
- The project led to different spin-off projects and activities.

b. Education and training

- Bachelor and masters scholarships in Costa Rica for students from El Salvador and Nicaragua were implemented.

- The project included PhD “sandwich” scholarships in Denmark for CA project participants. Most of these are now finished.
- Preparation for a PhD school in scientific areas related to the project area, as well as for masters and post-graduate programmes were supported by the project.
- The project provided training in the use of IT and the inter-net. Hardware and software investments were funded.
- Danish master students spent time in Central America, for example writing their master thesis in project relevant areas in connection to the partner institutions.

c. Dissemination

- Project members published research papers, conference papers, articles in journals, chapters in books, books, etc.
- There were especially in connection with the seminars contacts to politicians and decision-makers in project related matters. Project members carried out consultancy work in relation to project relevant topics.
- Some members achieved positions as decision-makers and research organisers partly as result of degrees and competences acquired through the project.

d. Administration

- The coordination of the complex 4-country project was very much facilitated by a close and constructive collaboration between the secretariats in Costa Rica and Denmark

d. Other, less palpable results, for example:

- The project contributed to the introduction, development and diffusion of aspects of the “innovation and learning capability approach” and the “social construction of technology approach” to contribute to innovative development research in CA.
- It also contributed to confidence building in the use of new conceptual tools, e.g. challenging some of the dominance of US neo-classical economics, as well as introduction of a more knowledge sharing and interactive approach to research.
- It led to increased awareness of interactive ways of teaching at the partner institutes in Central America, eventually leading to introduction of problem based learning at some departments of the respective universities.

- And not least, the SUDESCA project contributed to the research capacity in sustainable development at Aalborg University.

5. The impact on the Central American research capacity

Which aspects of research capacity were affected?

The question now is if the activities mentioned above affect the research capacities of the host organisations? Furthermore, if there is such an effect, is it positive or negative? Have we enhanced or diminished the research capacity in Central America?⁴ To answer these questions we have to return to our conceptual discussion. Which aspects of the complex notion of research capacity may be affected by the concrete results of the SUDESCA project?

It is clear that the project design and the character of activities are in accordance with a *process-oriented view on research capacity*. The focus on scholarships, network building, interactive research methods, knowledge sharing and IT skills all aim at building capabilities and capacities for future use and at a continuing research process rather than at providing answers to concrete questions and solutions of concrete problems. Nobody questioned that this was a sensible road to take and there is agreement amongst the project participants that some improvement of “partial research capacity” has been achieved.

The project focused on building *concentrated rather than dispersed research capacity*. It is true that the project has been active in three Central American countries and that not only universities but also an NGO have been participating. But there has been a rather narrow scientific focus on systems of innovation. This was also an intention behind the project design and it is obvious that for a single project, looked upon more or less in isolation, this is the right approach⁵. Furthermore, there is an increasing attention to the importance of networks, partnerships and knowledge sharing in both development

⁴ A negative answer to this question is clearly possible. We may, for example, have diverted and misused existing scarce capacities and we may have led the use of these capacities into unproductive directions. Such, unintended, misuse of resources is, however, usually not discussed in evaluation reports.

⁵ SUDESCA was the only ENRECA project in the region within the social sciences during its whole existence.

theory and policy and taking this into account the focus on innovation systems in the SUDESCA project was well-judged.

However, in spite of the fact that the system of innovation approach underlines the importance of interaction and cooperation between different kinds of organizations, the contacts to private sector firms and organizations have been modest. There were some early attempts to develop this kind of relations but this was given up later mostly because of time and resource restrictions. Seen ex-post, this may be regarded as a relative failure. Although interaction between some of the SUDESCA participants and public and private organizations is now emerging, public-private cooperation in general needs to be developed in Central America.

Research capacity was looked upon in a *broad rather than narrow way*. The overlaps, relations and feed-backs between research, education, and application of research results were acknowledged from the beginning and throughout the project. There have, for example, been made efforts to apply SUDESCA research approaches and results in the teaching at the participating university departments and some of the funds were used on bachelor- and master scholarships in the region. An important aspect of the system of innovation approach implied the combined focus on research and education as well as adherence to networking and interactive research.

It is not quite as clear if the results indicate a concentration on *individual research capabilities or collective research capacity*. It must be noted that several other projects, both parallel and posterior to SUCESCA, were and are being carried out, giving evidence of both collective capabilities to launch new research projects, and the possibilities to get funding in different ways.

Obviously, since the main thrust of the innovation system approach is to view both R&D and innovation as collective processes it would be logical to aim at supporting the collective research capacity. However, a substantial part of the budget was devoted to individual scholarships and the lasting organizational changes at the host universities resulting from the project are probably rather marginal. On the other hand, networking and interactive learning and researching have been central elements all the time. There has, in other words, been a mixed focus in this respect.

Finally, walking on the two legs of enhancing both *research capacity and research opportunities* has really only been possible within the limited framework of the

SUDESCA project itself. In a modification of the terminology of Thulstrup referred to above, partial, but not national, research opportunities have been affected. How research opportunities in Central America develop in the future is largely out of influence for the present group of project members. However, as long as the network connections and research co-operations nurtured by the SUDESCA project hold forthwith, this will also support the capabilities of researchers and their organisations to take advantage of existing research opportunities.

6. Problems and pitfalls

The fact that the different aspects of the research capabilities or capacities of the involved individuals, groups and organizations have been affected by the project does not imply that it, by and large, has been a success. In this section we will discuss how the results may be evaluated. Especially, we will take up some pitfalls and problems in the efforts of knowledge transfer, which have been illustrated in the course of the project. We will also identify what we regard as the most positive results.

A usual problem in these kinds of projects is that the political and socio-economic assumptions behind the project design and funding may not hold totally. In such cases, publicly financed projects do not often have the flexibility to adjust quickly to new situations. The present project was, as most other projects, affected by unexpected events. Political changes in the leadership of one university diminished the influence of the project members and political conflicts at another university blocked some of the project funds. These problems were time consuming and impaired some aspects of the project performance, but, of course, it could have been much worse and the situation was manageable.

The lesson is that in order to contain the damage done by unexpected events, the design and planning has to be based on explicit assumptions, and there has to be some slack in the funding of these kinds of projects. More specifically, distributing the resources too thinly over many activities and sub-projects is likely to lead to strain, irritation and reduced efficiency, when unexpected events require reallocation of the resources. This was an experience we made.

During all phases of the project resources seemed to be very strained. They were not just scarce, they were blatantly insufficient. Partly this was due to unrealistic assumptions about working conditions for university staff in Central America.

Low wages often force the researchers to take on consultancy work and other types of jobs. Since the project was unable to compensate fully for the necessary research time, strains and delays reduced output in relation to what was expected in the plans. An overoptimistic project design had the result that also small unexpected disturbances affected the implementation of project goals.

It is also necessary to take into account that data-bases are very poor in CA. A big part of the time is used in generating information, which is very different from the conditions in developed countries. This strains the budget and the time for analysis and writing becomes very short. A related problem is that the data-bases created for some research projects are so specific that they rarely are useful for other researchers.

A concrete consequence of the combination of too high ambitions and too dispersed resources was that inadequate resources were put into the PhD-projects. The so called sandwich model in which the PhD student divides the time between the home university and the partner university is without doubt a good model, but it requires that a very substantial part of the time is spent at the partner university. Very often the working conditions are not good enough at the home university. The research infrastructure (libraries, ICT facilities, seminar activities, etc) and the time available often don't allow a sufficiently focused and sustained research effort. Seen ex post it is clear that the SUDESCA project did allocate too few resources into its PhD-program.

Another example is a sub-project of writing a book about crucial aspects of local and national systems of innovation in Central America that involved most of the project participants as authors. This was not in the original plans, but the idea was raised halfway through the project. The intention was to increase the cohesion of the team by a collective research effort and to provide publication incentives especially for the more inexperienced members. The writing of such a book turned out to be much more difficult and take much more time than expected. In 2006 the book is still not quite ready for publication. The main problem seems to have been lack of paid time and too few workshops and other gatherings for the group of authors. In retrospect it is clear

that the resources of the SUDESCA project have been too thinly spread out over too many activities.

It would have been useful if the ENRECA program had been able to assist with experience based advice in the final design of the project in matters of this kind. One of the advantages of organizing development projects in programs like ENRECA is that it becomes easier to accumulate experiences and make them available for new projects. The ENRECA program-staff seems to be well situated for this task. However, probably due to resource restrictions, such advice was not sufficiently available and the SUDESCA project had to rely entirely on its own experiences.

Other things than insufficient real resources also caused tensions. The propensity to communicate openly and rapidly about delays, unexpected events, changed plans, etc. was initially very low at the Central American side, and it only improved slowly in spite of relatively good ICT facilities. This may be a “cultural thing”; at least there were no easy resource scarcity explanation of it.

There were also other cultural asymmetries between Central America and Denmark, which reduced the actual knowledge transfer in relation to the potential one. Especially in the beginning, the Central American parties regarded the project more as an instrument for livelihood support than as a vehicle for research capacity enhancement. The expectations to the project differed between the two sides of the Atlantic.

Furthermore, in CA research is expected to contribute more or less directly to development processes. Development is “something to be done”, implying ex-ante policy approaches, and not just something to be explained by ex-post analysis. Research agendas are then very close to action agendas; researchers are involved in many action processes and not just in academic research. Because of that, consultancy work is not just a strategy to get an income; it is part of the culture of action research. When interaction with other actors in the systems grow, the demand for short term research or consultancy projects also grow.

It would clearly have been a good investment to use more time to discuss the different expectation and calibrate them as far as possible before the project was started and during its initial phases. Intercultural communication is difficult and costly, but also indispensable in these types of projects and if sufficient time is allocated to it, the returns may be substantial on both sides.

In addition to the tensions between the Central American and Danish parties there were also conflicts between the Central American ones. The project was designed to give the Costa Rican Party a position in between Denmark on one hand and Nicaragua and El Salvador on the other. Costa Rica has a much better infrastructure and research capacity than the other countries in the region but cultural affinity and good knowledge about local conditions supposedly make interregional communication easy. It was therefore assumed that this project structure would reduce the total communication costs. It may very well have done so, but it certainly did not make them disappear. At the same time it increased the rivalry and suspicion between the Central American parties. Again the lesson seems clear. Knowledge transfer requires joint communication and interaction between all involved parties, but this may be costly and time consuming. A realistic attitude to these things is a precondition for success.

Finally it needs to be said that the SUDESCA project also faced unexpected events emanating from its funding agency ENRECA. The project design was based on ENRECA's original 12 year funding horizon. However, when Denmark in 2001 did change from a social democratic to a neo-liberal government, the ENRECA programme was closed down as semi-independent agency and merged with DANIDA's other development research funding facilities. As a result there was no funding of the planned third phase of the project. It was substituted by a "phasing-out project.

Another from the beginning unforeseen thing was that the ENRECA projects, which originally were to be based on demand-driven activities from the recipient partners, were instructed to liaise with new sector support programmes initiated in DANIDA's development assistance portfolio. There may have been good reasons for this, but it also made research activities more supply-driven and obstructed the close interactive *user-producer* perspective.

7. Conclusion

The way we look at it, there are at least two types of positive results of the SUDESCA project. First, there are a number of quantifiable outputs like research reports, other publications and PhD degrees. Second, the individual research capability of many of the project participants have improved through the research training and research cooperation provided by the project. Project members have participated in workshops,

seminars and conferences. They have written, presented and defended scientific documents of different kinds. They have applied some of the research results in their teaching, etc. There is no doubt that this learning by researching has increased their individual research capabilities.

We are less certain about the extent to which collective research capacities have been strengthened. As mentioned above it is important that individual capabilities are brought together to support and reinforce each other in durable ways. Otherwise they tend to erode over time.

One simple indication of collective research capacity is if concepts, theories and methods, which are developed in the project are carried over and utilized in new research projects, i.e. if the project is able to support and contribute to new research activities with other sources of funding. This is to some extent the case. For example, a couple of projects about the application of ICT technologies to different types of education in developing countries may be said to emanate from the SUDESCA network, and SUDESCA participants have carried ideas and concept over into (international) projects about catching-up growth⁶. Furthermore, some participants have entered related networks and got recognition as “experts” on innovation theory in different both theoretical and political connections.

Another and maybe more clear-cut indicator of collective research capacity is the survival and further development of the research networks built up within and in connection to the project. For the SUDESCA project the results in this respect are mixed. When the project for almost a year was kept in uncertainty about the funding of the third and final phase, and then saw this phase reduced to phasing-out activities the SUDESCA research networks were severely damaged. Because research without specific funding is almost impossible in developing countries with poor research funding through universities, unfunded networks cannot survive for very long. Researchers need to find alternative sources of income very fast. Prolonged periods of uncertainty about funding are more destructive in the South than in the North. In spite of this, parts of the networks have survived and are now engaged in serious discussions about future research cooperation.

⁶ See for example the VISCA project (Virtual learning and Sustainable Development in Central America, <http://www.kommunikation.aau.dk/visca>).

A third indicator is the development of (existing or new) research organizations to include and support the knowledge and the capabilities built up by the project. The SUDESCA project did not lead to very much of this kind of capacity building. It should be mentioned though that the Costa Rican party (CINPE) grew and became much stronger during the whole project and this was at least to some extent connected to SUDESCA activities. Furthermore, key members of the SUDESCA project recently became Rector and Deputy Rector of Universidad Nacional in Costa Rica. Without doubting in any way that this were totally their own achievements it is reasonable to assume that they have been helped by the scientific training and by the PhD degrees they accomplished through the SUDESCA project. It is, of course, still too early to know if this will improve the organizational and economic funding of research at the university. In Nicaragua, to continue this line of reasoning, the first relatively independent research section was initiated at ESECA and led by SUDESCA members.

Finally we will draw the attention to aspects of research capacities in the border region between individual and collective capacities, which are totally intangible and without clear-cut organizational consequences. We refer to changes in openness, propensity to communicate and willingness to co-operate within the research community. During a workshop in the last phase of the project the participants were asked to answer questions about how their research capabilities had been affected by being members of this project. At least two types of answers were given by several participants.

First, the innovation system approach which draws on evolutionary theory rather than equilibrium theory proved to be an “eye-opener” bringing in new perspectives on sustainable development. Most of the project participants were, like almost all economists in Central America, brought up in a neo-classical tradition focusing on partial and general equilibrium and balanced growth. Breaking out of this tradition almost guarantees new perspectives on development as an unbalanced process in which institutional and technical change play crucial roles. We regard this as an important precondition for improved understanding of sustainable development and more realistic approach to development policies. Working together under a unifying alternative theoretical framework proved to be thought provoking and stimulating for most of the project participants.

The innovation system approach applied to the South was a revelation also because it changed their perception of innovation as such. Innovation was moved from being

something rather exclusively going on in the North into something also existing in and relevant for the South. This changed and enlarged the set of relevant development policy options.

Second, the focus in the innovation system approach on communication, trust-building and sharing of information and knowledge also inspired the ways the SUDESCA project was organized. Collaboration based on specific, well-defined projects was regarded as important for good results. The research training was carried out in cross-national and cross-organizational working groups and the workshops were organized with this in mind. This was different from a rather individualistic and uncooperative research tradition of Central American universities and was generally regarded by the project members as both stimulating and effective. To underline networking and knowledge sharing may seem self-evident in a project trying to build research capacity in the South with help from the North. Nevertheless it turned out to be a different, inspiring and useful way to work.

In short, both the CA and the Danish participants got an in-depth notion of what research capacity building implies including an insight into the socio-political and cultural embeddedness of research capacity.

Thus, assuming that research capacity may more or less be directly transferred from the North to the South is a mistake. Research capacity existing in the North has to be carefully adapted to the specific conditions where it may be expected to be useful. And certainly, only if the adaptation process becomes a joint venture, we may one day find in-dependent non-colonial scientists studying sustainable development in both the South and the North.

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