

Collaboration between Sweden and the Public Universities of Nicaragua

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**Department for Research
Cooperation**

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Sida Evaluation 03/31

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Cooperation**

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I. Summary

The public Universities of Nicaragua and Swedish institutions have collaborated in research activities and in training programs for already twenty years. The present level of the cooperation agreement 2001–2003 amounts 70 million SEK plus the specific support in institutional cooperation technical investments amounting 27 million SEK for 2002–2003. In addition to this, the collaboration has been supported by at least two other parties: the Nicaraguan Universities and the Swedish academic institutions themselves. In May 2001, Sida/SAREC appointed an international team to evaluate this long-lasting and complex collaboration. The Terms of Reference entitled as "Future Direction of the Research Cooperation between Nicaragua and Sweden" clearly delineated the limits of evaluation towards prospective actions. Consequently, this evaluation has made efforts "to give guidance on the future direction of the research cooperation and means for its implementation with the purpose of making the cooperation more sustainable and efficient", as stated in the Terms of Reference.

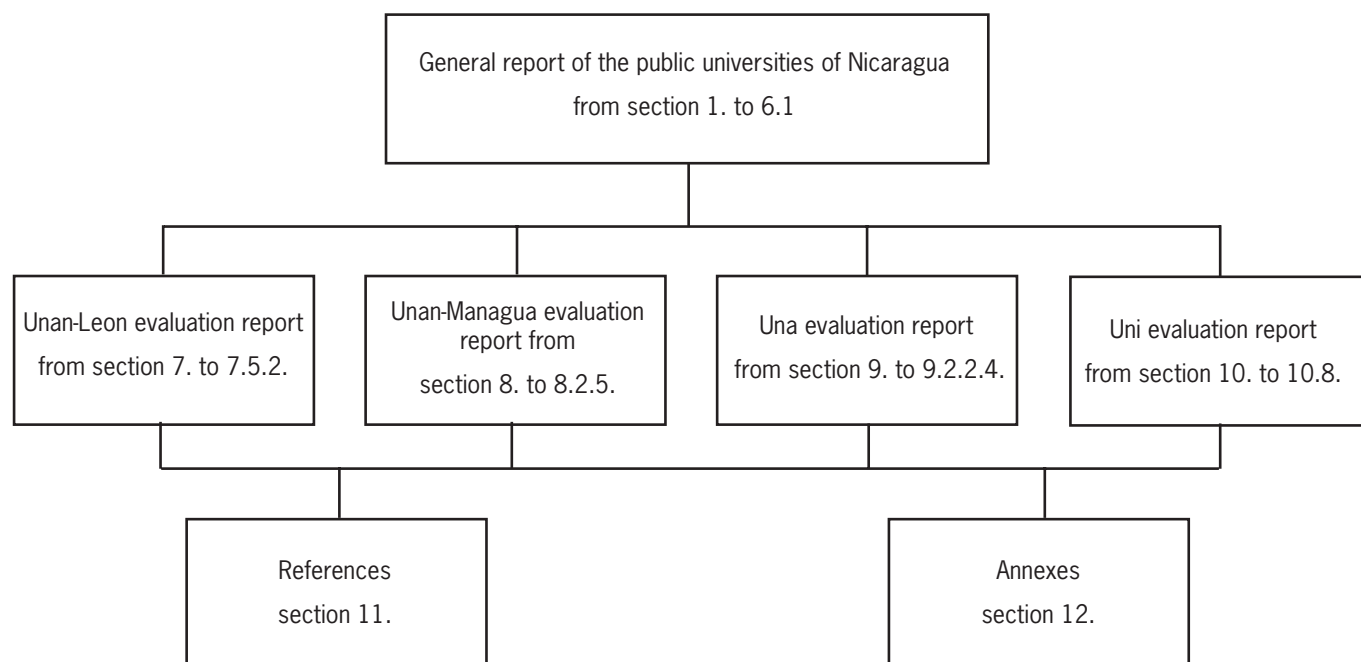
The present study has been arranged into twelve sections, each of them subsequently divided into various subsections. The first six sections constitute the general report, while sections 7. to 10. constitute the individual university reports. The first section (1.) describes the scope of the study making emphasis in four aspects that serve as a general background and justification of this evaluation. We initiate with a brief historical description of the public Universities within the context of Nicaragua and the framework on which the Sida/SAREC bilateral cooperation began and how it evolved. Then, we discuss in some detail the purpose of this evaluation according to the Terms of Reference and within our parameters as external evaluators. The second section (2. to 2.3.) describes the methodology used in this study making emphasis in the strategy, in the acquisition of oral, published and written information and the elaboration and distribution of questionnaires. In addition, we describe the methodology followed during direct interviews with individuals, groups and workshops. In the third section (3.) we explain the limitations of the study and the difficulties confronted during our evaluation and how these circumstances may affect our testimony. The fourth section (4. to 4.6.4.), and the core of this study, concentrates in the findings. The following subsection settles the conclusions, recommendations (5. to 5.5.3.) and lessons learned (6.) common for all Universities within the framework of the Sida/SAREC general objectives and perspectives for the future. The next sections (7. to 10.8) are comprised by four evaluations relevant for each Nicaraguan University performed by one or two of the evaluators, according to the Terms of Reference. **It is intended that the specific and idiosyncratic information for each University is extracted from these individual reports.** The sixth section (11.) shows the most relevant references used in this study. Finally, we conclude with the annexes (12.), which serve as quantitative and qualitative support of this study

Although the experience regarding the cooperation varies among the different Universities, there are common findings, drawbacks and solutions shared by the four public institutions. The main findings can be restricted to four significant points: those related to sustainability, those connected to the efficiency in the administration and University policies, those applicable to the efficacy in the training programs and those pertinent to the links with society. Among these, the major problems are related to efficiency and sustainability. It is necessary to promote the diversification of founding sources through grant applications and economical enterprises based in research activities. Universities should use their comparative advantages and establish strategic relationships. Alliances must be carried at national, regional and international levels. The coordination offices for research should be reinforced in order to consolidate the efforts of these administrative units. Additional assistance in the routines for the management of research funds is recommended. Adequate level of repetition in training fields and support to the same projects should be achieved in order to establish a "critical mass" of investigators and to reduce the susceptibility of the research groups. It is also necessary to diversify the graduate

training models; this will improve the efficiency in graduation and the academic proficiency of the Nicaraguan students enrolled in the bilateral collaboration. In addition, candidates should be subjected to precise academic rules and deadlines. The various research projects should maintain an adequate level of communication and enthusiasm between the Nicaraguan and Swedish counterparts. It is essential to identify priorities and to reconsider some of the ongoing projects that maintain an extreme level of tolerance with very little results. Changing subject or retirement may be a constructive alternative. Efficiency, trust, frankness and high academic standards must prevail under all circumstances. It is mandatory to avoid for students and well-trained investigators recently hired to be enrolled in administrative positions, to be overloaded with teaching duties or to engage in second jobs, since all these activities limit their time for research. Plans and official recognition of research activities should be linked to concise and specific credits and privileges and be part of a concerted system among the various research groups, the Faculties, Departments and the Directions of Research. It is urgent to define strategies for increasing salary levels and for the development of incentives, making research an attractive option. Economical enterprises based in research activities and knowledge must be achieved in order to contribute to the research projects and open possibilities for financing salaries of academics and technicians. Strategies for preventive maintenance of equipment should be incorporated as a common practice. It is important to reinforce the direction and objectives of the Sida/SAREC cooperation and to distribute the information evenly among the various academic strata. Careful planning and step-wise measures are necessary when changing Swedish personnel assigned to the bilateral cooperation. Permanent strategies for the internal and external monitoring in the bilateral cooperation must be developed to a larger extent and a culture of preventive management must be developed in all actions related to the cooperation. It is strongly recommended the maintenance and expansion of the Sida/SAREC bilateral program until the University research groups acquire more efficiency experience and independence.

The commentaries, conclusions and recommendations put forward in this evaluation will serve not only to identify achievements, but above all, to resolve and prevent problems that inevitably arise during long term and complex interactions between different parties. This evaluation will also serve as a reference for formulating strategies for the sustainable development of research in the National Universities of Nicaragua and for future projects developed by Sida/SAREC. Our criticisms are not intended to please but to convince. In some cases we suggest urgent adjustments of attitudes, procedures and strategies; while in others we recommend to devise new solutions to new and old problems. Although we have learned that several of the problems indicated have been partially solved, we have insisted on them on the grounds of their importance for the collaboration. This also means that we understand that the magnitude of the problems have changed with time. In this direction we have also learned that public Universities of Nicaragua have reached a more mature position with respect to previous years, and now they are capable of perceiving with more clarity the relevance of research enterprises in the context of academic activities.

Flow-sheet Design of the Evaluation Report



1. Introduction

Central America composed by Guatemala, Belize, Honduras, El Salvador, Nicaragua, Costa Rica and Panama, spans a thin region of 523,000 Km² that joins the two continental masses of North and South America. Despite of sharing the same geographical area, major political, economical and historical differences demarcate the various Central American countries (see annex 12.7.17. Table 1). Nicaragua with 130,000 Km² located between Costa Rica (South), and Honduras (North) is in the middle of the Central American isthmus. The country comprises a community close to 5 million inhabitants with an active population of 1.7 million and unemployment rate close to 40%. Despite this, signs of slow progress are foreseen (Table 1). The economy of Nicaragua is very fragile, most of it depending on crops, animal husbandry and international contributions. Approximately 50% of the active population is dedicated to animal husbandry and agriculture. The former mentioned industry is among the ten most relevant sources of income to the Nicaraguans economy and a source for permanent jobs (<http://www.iicanet.org>). This industry is also important from the social perspective since it avoids demographic movement from rural to urban areas. However, due to economical constraints and a high unemployment rate, emigration to other countries is a frequent event.

Nicaragua must struggle against poor or non-existing national budgets for research, limited laboratory facilities and a few research groups, most of them laboring at the National Universities and a few in the Ministries of Nicaragua. This limited research activity is reflected in the low number of international publications (<0.001% of the total world indexed publications in 20 year period) registered in the Institute for Scientific Information (ISI, Philadelphia, USA CD-ROM 2001; <http://www.isinet.com>); low number of research proposals registered in the major financing agencies (except Sweden); and limited presence of Nicaraguans in international scientific congresses and symposia. Is, therefore, within this context that the Public Universities of Nicaragua play a crucial role in the advancement of research activities and in the progress of scientific thinking for the country's development. Is also within this context that the Swedish International Development Cooperation Agency (Sida) and the Department for Research Cooperation (SAREC) play a very important role by supporting the research collaboration in Nicaragua.

The Swedish research cooperation to Nicaragua initiated on a small scale before the Sandinista Revolution, by founding a reduced group of social scientists exiled in Costa Rica during 1978–1980. With the new Sandinista government installed, an agreement was signed between Sweden and Nicaragua in 1981 [Ganuza 1988]. Close to 90 million Swedish kronor were assigned for research collaboration between 1980 and 1990, corresponding to 4% of the total Swedish assistance to Nicaragua. The present level of the cooperation agreement 2001–2003 amounts 70 million SEK plus the specific support in institutional cooperation technical investments amounting 27 million SEK for 2002–2003.

Initially the aim was to create research capacity in the areas defined as priority by the Nicaraguan government with strong participation of the public Universities. The cooperation initiated with the so-called “sandwich” training model. In this model, professionals from the Nicaraguan Universities, mainly in the fields of agriculture, medicine and a few technological and engineering enterprises, performed graduate training (mainly at the level of MSc) in Sweden while executing a significant part of their research in Nicaragua under the supervision of a Swedish tutor. A general perspective of the results achieved from 1980 to 1993 were expressed as follows in a general evaluation of the Swedish assistance to Nicaragua:

“Summing up, SAREC’s support to research in Nicaragua has worked well in one sense, but not in another. It has financed a number of projects and programs which have produced output in terms of research results and high-caliber training

However, the support provided has not always been clearly in keeping with development objectives of the country and has been spread out among too many institutions and projects. The capacity-building aspects have been somewhat overlooked. These factors have, in turn, tended to lower the efficiency of the assistance.” [Behar and Lundahl 1994].

Even though we may agree with several of the points of this statement, we still believe that Sida/SAREC support of research activities has had an important impact in the development of Nicaragua. This is frequently overlooked because the impact of the scientific knowledge and research activities commonly escapes direct and obvious measurements in society, mainly in low-income countries that have struggled for centuries. Yet, scientific knowledge similarly to artistic activities, permeates all levels of society, however, its impact increases gradually in the subsequent generations. For this reason the impact of science in the development is mainly observed in the long run and detected as a subtle network that slowly increases the quality of life. By a refined and accurate sight it is possible to detect the role that research performed in the public Universities has played in the development of the Nicaraguan society. In this sense Sida/SAREC has greatly contributed to this process.

It is precisely for this reason that the present evaluation of the four public Universities of Nicaragua is intended to serve as an instrument for measuring the impact and effectiveness of the bilateral cooperation between Sida/SAREC and the public Universities of the Republic of Nicaragua. Although we have reviewed and taken into consideration the Swedish assistance to the Nicaraguan Universities for the last 20 years, **this evaluation has concentrated in the present situation and on prospective actions, as stated in the Terms of Reference (see annex 12.5.), rather than to describe the collaboration in restricted historical terms.** Therefore, our report concentrates on current achievements and problems rather than on past actions. For those interested in details of the historical development and previous perspectives of the Swedish cooperation with the public Nicaraguan Universities, we recommend reviewing the works of Allebeck and Nieto [1994], Brunner and Krister [1994], Ganuza [1988], Larsen [1990], Liberknecht [1994], Long [1987] and Ståhl [1992] cited in the References of this study (see section 11).

One of the main purposes of this evaluation has been successfully achieved. In February 2002 Nicaraguan **Universities initiated and developed an open and fruitful discussion, in the form of workshops, regarding the Swedish cooperation and the future of research within these institutions.** This has been a major achievement since for the first time the Nicaraguan Universities, together, have confronted the past and the future of the bilateral collaboration. In addition they have evaluated in their own terms the impact that this cooperation has had on their academic life.

Another purpose of the evaluation, intended as a contribution to **the discussion among the Swedish counterparts on the efficiency of their participation within the framework of cooperation** with the Nicaraguan Universities, has also been achieved. An internal and external debate (see annexes 12.12. and 12.12.1) regarding the objectives and their change and development through time, is presently being discussed among the different participants within the institutions that collaborate with Nicaragua. Similarly, Sida/SAREC has initiated a fruitful and elaborated discussion regarding the collaboration in the light of past and present objectives, a fact that fulfills an additional goal of this evaluation.

As expected from entities that constituted a single University in the past, the fundamental principles of the Nicaraguan Universities are similar, but not identical. Significant idiosyncratic differences among them were detected and in turn taken into consideration during this evaluation. Although this study aimed to have an overall perspective of the cooperation, several of our objectives were devoted to unveil the circumstances of the Universities in relation to their Swedish counterparts. **The evaluation includes not only general perspectives, but also specific subjects and details which**

should be viewed under narrower parameters. Due to these circumstances, the reader will find specific comments for each project and/or research group in the evaluations performed for each University. By this process we were able to identify common problems and to envision more general solutions, which in our view constitute the core of this study.

We hope that the commentaries, conclusions and recommendations put forward in this evaluation will serve not only to identify achievements, but above all, to resolve and prevent problems that inevitably arise during long term and complex interactions between different parties. We also hope that this evaluation would serve as a reference for formulating strategies for the sustainable development of research in the National Universities of Nicaragua and for future projects developed by Sida/SAREC.

2. Methodology

2.1. General plan for the evaluation

Lea Velho, Thomas Alveteg and Edgardo Moreno constituted the first Evaluating Team. Lea Velho was initially appointed as a team leader and assigned to evaluate the Agriculture projects developed at UNA. Thomas Alveteg was assigned to evaluate the engineering cooperation with UNI and the environmental program with UNAN-Managua. Edgardo Moreno was appointed for evaluating the health cooperation with public UNAN-Leon and with UNAN-Managua. Planning and implementation of the activities was performed by the members of the evaluating team in coordination of members of Sida/SAREC who also participated in workshops during different phases of the evaluation.

A flow sheet demonstrating the general plan for the evaluation is presented in the annexes (see annex 12.6.). The team met for the first time the second week of May 2001 in Stockholm and initiated fieldwork and interviews at the different Swedish academic institutions concluding the last interview the 11th of May 2001. Edgardo Moreno performed two subsequent interviews with Swedish counterparts the third week of August 2001 (Umeå University and the Karolinska Institute) and the second week of February 2002 (Karolinska Institute). One interview with a Swedish counterpart was performed in Costa Rica. The first week of June, the team initiated interviews, meetings and workshops with University authorities in Managua Nicaragua and with the individual Universities in Managua and Leon. Team members split to work with the individual Universities according to a development plan by the team leader of the first visit (Lea Velho). A written report elaborated by the assigned evaluators and a general report on the Nicaraguan Universities expressing the personal views of the former team leader Dr. Velho were submitted to Sida/SAREC, to the Nicaraguan Universities and Swedish counterparts for revision and criticisms. During this course Dr. Lea Velho abandoned the evaluating team. Members of the remaining evaluating team, Thomas Alveteg and Edgardo Moreno, performed subsequent field works in Nicaragua and planning of the final report.

The second part of the workshops for the evaluation was accomplished in Nicaragua the third and fourth weeks of February 2002. The Evaluating Team initiated meetings and workshops with authorities, research groups and students from the four public Nicaraguan Universities. Brief oral presentations on the evaluation were performed at each University. Criticisms, recommendations and documents were collected on site by the evaluators. Workshops based on “reflection groups”, conferences and group discussions were performed in each University and material collected on site and subsequently by E-mail or fax. All data collected during the evaluation was processed by the Evaluating Team in the following weeks. The final report was elaborated according to a general plan used with Sida/SAREC authorities and to the Terms of Reference (see annex 12.5.). The manuscript was then submitted to Sida/SAREC, to the Nicaraguan Universities and to the Swedish counterparts for final revision.

2.2. Strategy and Modus Operandi

2.2.1. First visit to Sweden and Nicaragua

The format and dynamics of the evaluation workshops were not only designed as a means to obtain information for the evaluation but also as a process to be conducted by the Nicaraguan universities. Workshop attained with the representatives of the public Nicaraguan Universities were presided by a local coordinator and facilitated by one of the evaluators. The coordinator opened the meeting, explained its objectives and presented the documents prepared for the workshop. Then, the team leader made a short presentation of the evaluation procedures, explaining the importance of the workshop for the evaluation and future of the cooperation. Following, she gave conceptual framework of the evaluation exercise and explained how to proceed for the rest of the workshop and for the rest of the evaluation study. The following concepts were put forward for discussion: research capacity building; critical mass; sustainability; program ownership; autonomy; demand-drivenness; multidisciplinary; social, economic and scientific impact. The local coordinator gave instructions to participants and formed the groups for the workshop.

Organization of group discussions was planned to last for 1:15 minutes with 6 to 8 members per group and of different backgrounds (faculty members, graduate and undergraduate students, staff members, policy makers and other research users) in each group. One faculty member with experience in the bilateral cooperation, designated by the local University, was the facilitator of each group making sure that the questions suggested by the evaluation team (see annex 12.14.1.) and other questions proposed by the group itself were discussed. This faculty member also facilitated a process within the group to select a group rapporteur who summarized the main conclusions of the group and present them in 5–10 minutes to the final plenary session. After 1:15 minutes of discussions, participants again meet in a plenary session presided by the local program coordinator. Thirty minutes were assigned for rapporteurs presentation and 30 minutes for general and final discussions in a final plenary meeting and 15 minutes for closing the workshop. The total duration of workshops was between 4 to 5 hours. The main discussion points and conclusions were given to the evaluation team 3 days after the workshop. The evaluators did not participate in the discussions.

Two different questionnaires (see annex 12.13.) were given to academics involved in the Sida/SAREC cooperation. Questions were divided in four clear-cut categories to facilitate the quantitative analysis. Questionnaires were filled anonymously, included in a closed envelope and personally collected by the evaluators. In addition, one section for general commentaries (1/2 page) was allowed. Specific qualitative questionnaires were given to the team leaders of each project (see annex 12.13.1).

Direct structured interviews with the various Nicaraguan and Swedish groups and with team leaders were attained. The same basic questions were asked, letting the individual and groups to speak freely during one to two hour interviews. These interviews were carried out in Leon and Managua, Nicaragua; Stockholm, Lund, Uppsala and Umeå in Sweden; and Heredia in Costa Rica. The general written comments and indications were pondered and compared with the responses and commentaries to the questions raised in the direct interviews.

2.2.2. Second Visit to Nicaragua.

Two different workshop types were carried out. The first type was performed with academics and students participating in the bilateral collaboration from each Nicaraguan University; the second workshop was a general activity with the joint participation of selected academics and students from the four public Nicaraguan Universities involved in the bilateral collaboration with Sida/SAREC. Each workshop included introductory presentations by the evaluators on the individual or general preliminary evaluation reports, oral presentations by the University representatives rendering various

University perspectives on the evaluation reports, and a general discussion on the conclusions of the preliminary evaluations. Individual workshops lasted from 1 to 2 hours.

Working sessions following the method of “reflecting teams” were performed in each University or in the final joint meeting attained by all public Universities. Reflecting team strategies promote the active interaction among the participants and facilitate the process of formulating recommendations. Briefly, reflecting teams were organized in three different groups: students recruited by the Sida/SAREC bilateral collaboration, University authorities and a mixed group of students and authorities. Each session lasted 25 minutes, according to the following protocol: groups from 4 to 8 individuals were located in the center of the room, facing each other, in the sense that they could not face the audience which was disposed around this group. A panel of three themes, each one including from 3 to 5 questions (see annex 12.14.2), was put forward for discussion. The first group discussed the first theme, the second group the second theme and the third group the third theme. Slight variations adjustments in the phrasing of the questions were performed in order to make them pertinent for each working session at the different Universities. Only the members within the group could discuss the questions. One secretary was appointed for taking notes, which later were typographically transcribed and handed to the evaluators. After concluding the reflecting team sessions, a general discussion with open participation of the University personnel was carried out. The evaluators did not participate in the sessions or in the discussions. Each working session lasted from 2 to 3 hours.

2.3. Data Sources

At least six different sets of data were used for the evaluation. The first one constituted periodical reports written by the participating Universities and Swedish counterparts to Sida/SAREC regarding the academic activities, performance and budget requirements of the different research projects. The second set of data included Sida/SAREC publications, evaluation reports on the Sida/SAREC and Swedish cooperation to the Universities in Nicaragua and to the country. The third set of data constituted Nicaragua’s University annual reports, publications and presentations on the general performance of the Universities and their activities. Periodical publications, journals, books and propaganda constituted the fourth group. The fifth set of data was constituted by the questionnaires filled by the different University participants. The last group consisted in data obtained from direct interviews, workshops, seminars and working sessions.

3. Range and main limitations of this study

As stated in the Terms of Reference (see annex 12.5.), this evaluation concentrates in the research project activities, efficiency of student training, efficacy of the collaboration between counterparts and on the viability and sustainability of the projects performed within the academic context of the Nicaraguan Universities. Therefore a significant proportion of academic and philosophical relevant issues related to the academic and institutional life of the Universities are not discussed in detail due to fact that they may not be directly related to the bilateral collaboration, but to the general Nicaraguan context. This condition, that is evident in the form on which this study is presented, does not mean that the evaluators have skipped details related to these realities and circumstances. Rather, the evaluators have made an effort to focus their attention to short term and long term specific solutions that could serve to improve the efficiency and sustainability of the bilateral collaboration between Sida/SAREC and the public Nicaraguan Universities.

Different sources of data have been used to construct this evaluation (see section 2.3.). Although some of these data can be identified and consulted in the references, “web” pages, and annexes of this study, a great majority of the raw information used in this evaluation is found as notes or manuscripts not

suitable for reference. In this sense, the reader is expected to give credit and hopefully trust (but with criticism) to the reflections, insights and experience that the evaluators have obtained during the course of this evaluation.

Despite our efforts in objectivity, this instrument as any other study is not perfect and may contain subjective statements that may require further revision. The reader may find disagreements in several of the conclusions, recommendations and philosophical perspectives in some of the specific documents presented in the evaluation. The reason for this may be found in the different experiences and viewpoints that the evaluators may have had at the time of judging the results, as well as the different experiences confronted in each University. For this reason, we have decided to include all the individual manuscripts generated by the evaluators regarding the individual Universities as well as one manuscript which represents the general opinion of one of the evaluators (Lea Velho) who participated in the first part of this study. We have also included commentaries of various Swedish academics referring to this written material for the reader to make her/his own judgment based on the written documents. The evaluators that participated throughout the process have, however, achieved a general consensus clearly exposed in the central part of this study.

We are aware of the inconvenience in repeating in the general evaluation (from section 1 to 6) several of the methods, judgments, conclusions, recommendations and lessons learned written in each of the University's reports evaluation (from section 7 to 10). However, for the sake of clarity we have decided to repeat some of these aspects also in the general section. We suggest the reader to review the individual University reports for specific assessments and perspectives (see sections 7., 8., 9., and 10.).

4. Findings

The National Autonomous University of Nicaragua (UNAN) was divided into two independent universities, the UNAN-Managua and the UNAN-Leon, in 1982. The Autonomous National University of Leon Nicaragua (UNAN-Leon) is located in the center of this small colonial city. The academic life of the University is linked to the every day life in Leon, facilitating the links between the academics of this ancient institution and other social groups. After a Swedish mission visited UNAN-Leon in 1980, the research cooperation with this institution began on a small scale in 1981. The collaboration initiated with training of MSc. in Microbiology and Parasitology and Social Medicine with a few pilot projects on infectious and parasitic diseases as well as in mining conditions under the "sandwich" training model. In later years, additional projects in reproductive and child health, mental health, occupational and environmental health and bacterial antigens were incorporated to the collaboration. More recently Sida/SAREC has been giving support for Library improvements, for the adequate management of funds and for building institutional research capacity, mainly through the Vicerrectory of Research.

UNAN-Managua is by far the biggest university in Nicaragua with 19,000 registered students. Besides the campus in Managua, four regional centers have been established in the various provinces. Traditionally the focus has been on education and training at undergraduate level, though in recent years efforts have been made to develop graduate study programs at level of Masters. Six research centers, independent from the Faculties and Departments have been established as part of a strategy to develop research and scientific capacity within the UNAN-Managua. The collaboration between Sida/SAREC and UNAN-Managua initiated in 1997, being this program the most recent project within this bilateral cooperation. Presently, research programs on the Geoscientific Research Center (CIGEO), the Aquatic Research Center (CIRA) and the Faculty of Medicine are the projects supported by Sida/SAREC.

Research activities in agriculture with SAREC support started in Nicaragua in 1980, with a project in legumes by the Ministry of Agriculture in cooperation with the University of Uppsala (SLU). From 1985 to 1987 the project was gradually transferred to the Faculty of Agricultural Sciences and Livestock of the UNAN, given that the research division of Ministry merged with the UNAN (which became National Agricultural University, UNA in 1990). For this move from the Ministry to the University it was also important that the Swedish counterpart was interested in extending the cooperation to the education area. Thus, in 1984 training under the “sandwich” modality was initiated in collaboration with SLU. In 1987 the partners reassessed the program and decided to broaden it. They included other crops and disciplines, like genetics and plant breeding, plant health, and renamed the program Plant Science. In the last few years (since 1997), support from Sida/SAREC to UNA has extended to other research related activities besides the formal graduate training of faculty members. This include institutional support and resources made available to projects to meet specific detected needs such as curriculum development.

Sida/SAREC collaboration to the National University of Engineering (UNI) initiated in 1985 with projects in cristallization and drying; areas that are considered important for the development of the agroindustrial sector in Nicaragua. Subsequently, projects in industrial control systems, data communications and applied electronics were slowly incorporated. During the first years, the emphasis was on the installation of laboratory and equipment and training. Then in the 1992, Sida/SAREC initiated support to research liaison activities, including the support to the Scientific Council, administrative development and research management. In 1992 some internal political constrains at UNI, limited the development of the Sida/SAREC collaboration projects and several graduates in the “sandwich” program moved from the University to industry and private enterprises. In 1995 a new Dean was elected and the Sida/SAREC programs were rebuilt with new students and projects.

The experience regarding the Sida/SAREC cooperation among the different research projects within the Universities is not equally distributed. This may be related in part to the time at which the different Universities programs incorporated to the bilateral collaboration. For instance some the projects of UNAN-Managua have just recently being incorporated (1997 and 2001) and therefore, the activities, mechanisms and the fundamental principles behind the collaboration are not integrated and comprehended at the same level as projects that have been longer in the collaboration. Despite this, the information regarding the cooperation seems to be well understood and evenly distributed among the different Universities and their objectives and activities have the tendency to be realistic. One important aspect was that very little interaction and exchange of experiences regarding the bilateral cooperation were noticed among the various Universities. Research activities related to Sida/SAREC collaboration carried out in one University seem to be ignored or not known by the other Universities, although some of these ventures are recurrent and of common interest.

The main findings detected in the public Universities of Nicaragua can be restricted to four main significant points: those related to sustainability, those connected to the efficiency in the administration, those applicable to the efficacy in the training programs and those pertinent to the links with society. General figures related to the present situation of the public Universities of Nicaragua are found in annex of this evaluation (see annex 12.7.).

4.1 General Benefits of the Cooperation

How should be judged the impact of Sida/SAREC assistance to the Nicaraguan Universities? Which parameters should be used to evaluate the outcome of this long lasting enterprise between two nations separated by the magnitude of the sea but linked by a thread of collaboration? Previous studies have dramatically emphasized the circumstances of the research system prevailing in Nicaragua after the Revolution [Ganuza 1989].

“The lack of a research tradition, the “brain drain” after 1979, the de facto situation of war which has reigned in the country for the past several years and a catastrophic economic situation have strongly limited the possibility of creating propitious conditions for research in the country. Empirical research, directly connected to the productive needs of the economy, is given maximum priority. The basic sciences have been practically neglected. Agricultural and social sciences predominate [...] Research structures, such as laboratories, scientific equipment, chemicals, libraries and documentation centres are deficient, unequally distributed and underutilized, in so far as they exist. Human resources, in the form of researchers with higher education (Master’s or Ph.D. degree), are very limited. The country lacks a national research policy or an institutional body that centralizes responsibility for such a policy. Local financing of research activities is very limited.” [Ganuza 1988]

The words written in this early study performed after five-year survey on the Nicaraguan conditions for research emphasize the circumstances prevailing in this country. They also serve to understand that accomplishments must be evaluated in the light of the preceding difficulties. Indeed, we must not judge the scientific achievements of the Nicaraguan Universities in pure quantitative and qualitative high ranking parameters used to evaluate academic and scientific performances in the so called developed countries. From our viewpoint, the bilateral program has to be judged on its significance and efficiency to educate people capable of understanding that research and scientific thinking are essential activities for development. Critical thinking within constructive parameters of specific activities (e. g. research devoted to improve education , production environment and health) are essential for the advancement of science and for its insertion into society. Under this perspective and at the present level of assistance, although it is not trivial to count the number of papers and graduates, it is much more valuable to determine if this way of thinking has spread at the various levels in the Nicaraguan Universities. At the same time, and as consequence of this dialectic process, it is also important to evaluate if understanding on the unique Nicaraguan circumstances has been implanted in the Swedish counterparts. Considering these, we believe that the Sida/SAREC assistance to the public Nicaraguan Universities in collaboration with Swedish academic institutions has been successful, however, not concluded.

The cooperation has contributed to erect institutional platforms dedicated to the promotion of science to procure research priorities. In addition, the cooperation has been valuable in improving routines for the management of external funds [KPMG 1999] and for administrative development necessary to support research activities. The modernization of laboratories, libraries, communications and institutional facilities for supporting scientific activities is also a positive outcome of the cooperation. Another positive aspect has been the generation of upgraded academics capable of lecturing at different levels. This event has a positive impact in the quality of courses in the various professional disciplines and in the creation of graduate programs. The projects supported by Sida/SAREC have also served as a framework for training students and technicians. In course, this has generated a group of highly motivated young investigators and trained technicians with improved laboratory skills and better academic preparation that are essential for the continuity of the projects. Young investigators have been motivated by previous generations trained in Sweden and are incorporated to research projects supported by Sida/SAREC. Many of these students already possess an adequate knowledge of the English language and have the desire to be trained abroad. In perspective, this has been also a positive experience transmitted from Nicaraguan investigators educated in Sweden, who have recognized the relevance of the English language for scientific training. The arrival of well-trained individuals to the public Nicaraguan Universities has generated leadership and favored the formation of some research groups within the lines of research supported by Sida/SAREC. Most of the groups maintain links with Swedish investigators and a few of them are participating in regional projects. Leadership has also concentrated resources and bringing people together. The creation of multidisciplinary groups, although not yet achieved is, however, seen as a normal and possible process within the framework of research activities.

Several works have stressed the benefits of the “sandwich” model for academic training [Hogstedt et al, 2001; <http://www.NetTropica.org>]. The most obvious benefit of the “sandwich” model is the generation of a considerable and significant group of well-trained individuals who maintain strong links with their home country and the University, reducing the chances of brain drain. Other benefits are the establishment of links with Swedish investigators and the generation of first class and upgraded research based upon Nicaraguan problems. The visits of Swedish counterparts to Nicaragua, and the close contact with Nicaraguan students have contributed to understand the reality of this country by the Swedish counterparts with relation to local problems. In addition, Swedish investigators have had the opportunity to incorporate relevant scientific questions in their research, derived from Nicaraguan topics. Similarly, the visits of Nicaraguans to Swedish laboratories have contributed to understand the benefits of performing high quality research under more favorable circumstances. The students and researchers participating in the bilateral program have published a number of international papers. These publications have been complemented by a number of abstracts presented in congresses and local manuscripts. All these publications constitute the scientific written testimony of the cooperation. Although the total number of international papers published by the Nicaraguan scientists is very low (< 0.001 % of the total number of papers published in the world during the last 20 years), Sweden is the major collaborator and the most represented foreign country regarding the scientific Nicaraguan publications in biomedical and agricultural sciences for the last 15 years (SCI-ISI, Philadelphia, USA CD-ROM <http://www.isinet.com>). This is a clear indication of the impact that the Sida/SAREC assistance has had in the scientific development of Nicaragua.

Nevertheless fund raising is still a fragile activity; a few research groups already have practiced it. Moreover, a reduced number of investigators have already generated small funds based on research-selling enterprises that have allowed them some independence. Others should appreciate this since it constitutes a positive example. Both, the authorities and the research groups have concerns regarding the future and sustainability of the projects and all Universities have carried out strong economical sacrifices to educate their academics in research. Several research groups and investigators have procured the integration of activities with the Nicaraguan community. In a few cases, the impact is clearly seen, in others the “seed has been planted”. This is a long-term process. A major part of the diagnostic activities and investigative enterprises performed by research groups (e.g. viral diagnosis by PCR) trained in Sweden are unique in Nicaragua and then represent a very valuable asset for the country as a whole.

Under our own perspective, the main achievement of the bilateral cooperation has been the generation of research groups capable of producing their own ideas and establishing priorities. In turn, this has generated enough self-confidence to rise constructive criticisms with respect to their own performance, to the University system, to the activities and attitudes of the Swedish counterparts and to the Sida/SAREC cooperation project. A great majority of authorities and academics consider research activities relevant for the Universities development. Even though this may sound trivial to investigators from developed Universities, this is a significant achievement in Nicaragua where research is not part of the country's tradition.

4.2. Significant Drawbacks

The main drawbacks identified already two decades ago [Ganuza 1988] still emerge nowadays in the general picture of the Sida/SAREC research cooperation with the National Universities of Nicaragua, but with notable differences in their magnitude. That is, although the problems and circumstances pointed out in the past still remain, most of them have diminished in magnitude, meaning that the collaboration provided a visible impact on the building of national research capacity. Therefore, the drawbacks cited here have to be placed within the adequate perspective.

Others have pointed out several of the drawbacks indicated here [Allebeck, and Nieto 1994; Behar and Lundahl 1994; Ganuza 1988; Larsen 1990; Long 1987]. We have insisted on them, but based on the “new” circumstances of the research activities existing at the Nicaraguan Universities. Moreover, recent problems have emerged as consequence of successful enterprises or due to the dynamics of the different groups. It is understandable that difficulties arise as a result of complex interactions, but also new problems are symptomatic and indicate progression in the bilateral cooperation.

4.2.1. Problems related to Sustainability

Sustainability is the major problem that research activities confront in the public Universities of Nicaragua. **In spite of the efforts, the projects supported are very dependent on the Sida/SAREC cooperation.** We are convinced that without this collaboration all research activities, laboratories, training programs and library facilities would dramatically deteriorate in a short time in all Universities. It is also likely that under these circumstances, the qualified personnel trained in the bilateral program would move from the public University context in order to explore better alternatives. This general problem is aggravated by several major circumstances discussed below.

Universities and groups supported by Sida/SAREC have accomplished very little fund raising in the form of grant applications or proposals written by individual investigators or by research groups. Regarding this complex problem, the achievements of the collaboration are far from being successful, and much more effort is needed. Graduates and the personnel from the administrative units are well trained and enthusiastic with respect to scientific activities, however, they seem not to be acquainted with fund raising strategies. Even though the desire is evident among different instances, there is not a dynamic attitude towards diversifying their sources and capturing the attention of other funding agencies. For instance, in a 27 year period (1974–2002) only four research grant related to fishery (a topic not within the bilateral collaboration) submitted by one public Nicaraguan University (UNAN-Managua) were been approved by the IFS (<http://www.ifs.se/>) and one by the TWAS (<http://www.ictp.trieste.it/TWAS/>). This unfortunate circumstance is even more dramatic when we consider that both of these research-funding agencies (IFS and TWAS) are not only devoted to support researchers in third world countries, but also proportionate the adequate facilities for submitting applications, albeit their links with Sida/SAREC. Moreover, both agencies extensively advertise their programs, most of which are within the fields of research performed by the Nicaraguan Universities. Similarly, applications to other agencies supporting research are scarce or absent (for an extensive list on granting agencies supporting Central American countries, the reader is invited to visit the <http://lwww.netropica.org>). To this condition, we have to add that local financing of research activities is very limited or simply does not exist.

An important problem linked to funding of research is the limited responsibility that Universities have demonstrated as national organizations to generate adequate circumstances to foster and institutionalize research not only within the Universities themselves, but in collaboration with other Universities and other institutions. Being the Universities the more active centers of research in Nicaragua, they should work together with governmental institutions to **built efficient technical national or University Councils** devoted to promote research and coordinate efforts with other institutions to finance scientific enterprises within Nicaraguan. The experience in Latin America is that organizations devoted to promote and finance scientific activities such as CONICIT, CONACYT, CONYCET etc, which were built by common efforts between Universities and Government, are very valuable in the development and reinforcement of research activities within Universities and for the countries themselves. **Once these institutions are created, Universities must secure their constant and active participation as the main partners in order to achieve efficiency.**

Another major problem is related to the limited perspectives for deriving benefits from comparative advantages. **We were not able to spot in the interviews, workshops or written recommendations, specific objectives for detecting comparative advantages, which are inherent of each country.** Comparative advantages are those circumstances that are mainly found in the home country and that are exploited for its own benefit (e.g. scorpion's venom in Mexico or National Parks in Brazil). Comparative advantages are found everywhere, but they require an incisive rationale performed by motivated individuals within interdisciplinary research groups. Without a clear perspective of the comparative advantages, mainly within the research projects supported by Sida/SAREC, it is extremely difficult to compete and to present coherent enterprises and tempting proposals for agencies to support or for establishing collaborations. Many constructive examples for deriving benefits of comparative advantages are found in Latin American countries [Fundacion UNA 2000; Mata 2000; Moreno 2000; Teixeira, and Benchimol 1993], and certainly they also exist in Nicaragua, but need to be extracted and used as stated.

Very little economical activities have been derived from research enterprises. The attitude that research and academic activities are not compatible with academic/research-based economical enterprises still remains among several groups at the public Nicaraguan Universities. This traditionalist view hampers the advancement of science, education and the integration of research activities with society and with productive sectors. Contracted investigations, paid diagnosis and consultant enterprises not only bring wealth and economical support to research and academic activities, but also contribute to increase the self-assurance of the professionals, and if developed under the adequate ethical circumstances, they may improve the salaries of the workers. In this sense, Sweden constitutes a chief example, since it is the country where private enterprises and academy have joined efforts more successfully and to a larger extent than other countries [IVA/VINNOVA 2002]. The needs of the Nicaraguan Universities are multiple and require sustained long-term enterprises. In this sense, detection of the Nicaraguan comparative advantages is also related to the achievement of what we call a "critical mass" (for definition see section 9.1.3) of investigators capable of performing coherent and concerted science with the ability to propagate and generate more research groups. This process does not occur as a spontaneous action, but a step-wise performance. Following this, we rarely detected a coherent initiative by the various public Nicaraguan Universities to focus in clear cut areas (although Sida/SAREC restricted the fields of collaboration) in order to gain prestige and expertise in a specific field but rather the tendency to explore and to gain support in everything. **Too broad expectations under the Nicaraguan reality work against efficiency and remarkably against the generation of a critical mass of investigators.** Experiences in other Latin American countries, related to the conception of strong research capacity, have demonstrated that support of a few research fields holding comparative advantages are highly efficient in constructing future scientific capabilities. With time these strong research groups will permeate other academic sectors and the number of qualify disciplines will increase.

A clear desire from the public Universities to link their activities and collaborate with different local and regional institutions was detected [CNU 1999], and perceptible examples have been indicated in the individual evaluations (see section 8.2.5). Notwithstanding these efforts, and taking aside those important exceptions pinpointed in the individual evaluations, **little scientific cooperation with local, regional or international (other than Sweden) researchers has been accomplished by the Nicaraguan investigators.** Although some research groups overlap on training, general objectives and disciplines, they have not merged in common enterprises. Others, who clearly complement their disciplines, do not know each other or have not established contacts. It is symptomatic that through out all our study, very few joint publications and grant proposals were detected among investigators and groups working in the same University; certainly, no joint research

projects supported or publications resulting from the bilateral cooperation were detected among the different Nicaraguan Universities.

The culture of establishing strategic alliances with prestigious international institutions, laboratories and individuals for increasing the quality and fund raising opportunities has not been cultivated and is not a common practice. This is more detrimental under the Nicaraguan circumstances, in which the number of active investigators is very low, and where complementary enterprises are necessary to explore and exploit their comparative advantages. This problem strongly links with the difficulties indicated in previous paragraphs.

Lack and deterioration of equipment are specific problems that hamper the day to day research activities [Thulstrup 1996]. A considerable support has been given to equip the various laboratories at the public Nicaraguan Universities [Sida/SAREC 2000a; Sida/SAREC 2000b]. Unfortunately, a significant proportion of the equipment has deteriorated and some of the laboratory facilities are in a relative state of disorder and very little maintenance and repairing of equipment has been attained. Moreover, in a few circumstances purchased equipment was never used or utilized to a very limited extent due to the absence of expertise for proper installation, repairing or lack of spare parts. In other cases purchased equipment did not have specific use, because the investigators who requested these items abandoned research activities or were performing studies abroad. Under these circumstances equipment decayed.

The deficiency of incentives for MSc. Ph.D. graduates and research groups is one of the most significant drawbacks for research development at the Universities. Arguments sustaining this conclusion are related to the absence of specific rewards that could motivate research activities and long-term enterprises carried out at the Universities. **The lack of incentives makes very difficult to keep the staff once they have finished their degrees.** MSc. or Ph.D. graduates cannot leave on scientific merits alone and therefore they have to search for better opportunities. Therefore, to abandon the University or to procure second jobs, some of them overlapping with University working timetable (see annex 12.8.2.), are alternatives that have been observed among several Sida/SAREC graduates. It can be argued that from the national point of view, the resources are not lost for society if the Ph.D. graduate abandons the University and works somewhere else in society. But still, as one of the main objectives of the bilateral cooperation is to create functioning research environment within Universities and built a critical mass of researchers, the absence of significant incentives works against these goals.

4.2.2. Problems related to administrative efficiency and research policy

A general and very important problem signed out by all instances was the absence of an official recognition of research enterprises, at the same level as teaching and administrative activities. From this standpoint, **research does not exist as a formal coordinated activity but as an unofficial one.** From all perspectives this position is less than detrimental for institutions believing in science and promoting the benefits of this line of thought. The fact that academics can only justify teaching and administration time but not research time works against the consolidation of a research system and against the aspirations of performing science at the Universities. This condition is symptomatic and reveals that Universities have not reached the necessary harmony among themselves and among the different Faculties and Departments to negotiate and recognize research activities as official enterprises. This is a significant handicap in the development of science, mainly because it reveals a philosophical attitude rather than a real practical problem. It seems that the National Council for Science and Technology is very weak and does not have the ability to formulate or implement any congruent research policy in this respect as well as in other matters related to the promotion of science.

The administration of research funds still remains as a significant problem [Behar and Lundahl 1994; KPMG Peat Marwick Nicaragua S. A: 1999]. Although routines for the management of research funds have improved in all Universities, the strict and rigid public administration rules of Nicaragua gives little space for Universities to make funds readily accessible for research activities. Throughout the interviews performed with different groups, repeated complains were evident of the investigators, academics and technicians about the slowness of the bureaucratic routines for the disbursement of funds and for purchasing equipment, reagents and other items. Improvement of fund administration routines does not exclusively refer to the reliable management of funds, but also to the efficiency by which these funds are accessible to the investigators. **The goal should not be to demonstrate that the funds have been managed in a reliably manner (although this is a prerequisite), but that these funds are efficiently used for promoting research activities.** It seems that a difference in perspective between University administrators and researchers generated a gap with a negative impact for the efficiency of the investigative enterprises. A related problem pointed out by most research groups was related to the time wasted at the customs. Clearance of equipment and materials from customs remains as a problematic and difficult adventure and not clear solution was detected in our interviews with University authorities.

The present political conditions at the public Nicaraguan Universities for the bilateral collaboration seem to be favorable, both at the Faculties as well as the central administrative level. However, this situation has not been stable and several problems have been generated in the past (see section 10). The current administrations have put a lot of effort in defining goals for the development of research capacity [CNU 1999]. But **research at the Nicaraguan Universities is very susceptible to political changes.** A relevant issue that affected research capacity in some of the Universities was related to the presence of opportunistic leaders not committed to the long-term development of research within the bilateral cooperation (see section 10). Faculties and groups involved in the Sida/SAREC bilateral program have experienced such periods where the capacity build up, with support from Sweden, has been lost or deteriorated (see section 10). This strong susceptibility of research activities to variable political circumstances should change.

Lack of time for research mainly comes from three different sources. The first two come from the tendency of well-trained investigators under the bilateral program to procure administrative positions not directly related to research or exhausting teaching activities. Moreover, some of these positions have been attained during their graduate studies, a factor that it is not desirable from many different perspectives. In many cases the time spent in Nicaragua by the students enrolled in the bilateral program is to a large extent consumed on teaching and administrative work rather than in research activities towards her/his graduate training. It is of course not an easy task to combine the duties in a high ranking administrative positions and at the same time be committed to Ph.D. studies or scientific enterprises. The fact that a considerable proportion of academics are enrolled in alternative economical activities outside the University accounts for the third cause (see annex 12.8.2.). Moreover, in various cases the working sessions between both jobs seem to overlap generating additional constraints. These three problems obviously are linked to the low University salaries. Altogether, they attempt against research efficiency due to the fact that scientific enterprises require concentration and time. However, under these situations **research suffers more than other activities, because academics with second jobs use the remaining University working hours in teaching or in administration, rather than in scientific enterprises.** This condition is also linked to the absence of recognition of research as an official University venture, as compared to teaching or administration, which are officially recognized. If research is not officially recognized, then there is no point (from the instinctive standpoint) to devote time to an activity that is not formally enumerated in the records.

Most of the investigators perceived that during the first 10–15 years of the bilateral cooperation, the decisions were not symmetrical. That is, most of the decisions were taken in Sweden and not in Nicaragua. Although this asymmetrical relationship has equilibrated in the last 5 years, about 1/4 of the investigators (revealed by the direct interviews, workshops and group discussions) still believe that a **major part of the decisions, including the distribution of funds and budget planning, are mainly taken by the Swedish counterpart.** In addition to this perspective, several of the investigators and authorities expressed that Sida/SAREC policies have not been always clear and consistent. Information is not equally distributed among the different academic strata and Universities, and contradictory information has been received at different levels during time. One of the major drawbacks indicated was related to the changes of the personnel assigned to the bilateral cooperation by Sida/SAREC in the eighties and early nineties. This caused misunderstandings and confusion in some of the activities. In conclusion, it seems that lack of communication and poor spread, of the information caused most of the misunderstandings.

4.2.3. Problems related to the efficiency of academic enterprises

The susceptibility of most research projects and academic activities is aggravated by the lack of repetition in the training field among the different investigators. That is, retirement of one investigator may imply that the project would also be abandoned, due to the fact that no other person is trained to take over the investigation. Very likely, teaching at undergraduate and graduate levels would also suffer from this absence. Leadership, mainly carried by well-trained personnel is even more susceptible, since in spite of their commitment, individuals are frequently tempted to perform other jobs. To this we have to add the gender imbalance among the different trained groups. Although this problem is more evident in some Universities than in others (see individual University reports), **still the number of females trained at graduate level is very modest.** The factors are multiple and very complex, but in general they relate to lack of real opportunities at the different academic strata. Depending on the training models and selection parameters, women may be handicapped to compete for graduate studies within the Sida/SAREC bilateral model.

Two “sandwich” models have been functioning at the various projects financed by Sida/SAREC: the open and the closed “sandwich” models. In the first model the student has a tutor in Sweden but he/she does not have a tutor in their home country; in the second model the student is under the responsibility of two tutors, one in his/her home country and one in Sweden. The virtues of the closed “sandwich” model have been described elsewhere [Hogstedt et al, 2001; <http://www.NetTropic.org>], and will not be discussed here. **Due to the reduced number of qualified scientists in Nicaragua whom could function as counterparts, most of the students of the bilateral program have participated in an open “sandwich” model.** This model has several disadvantages already pointed out in the specify evaluations and the reader is encouraged to review them (see sections 7, 9 and 10).

An additional problem linked to the sandwich model is related to the planning of courses. In many instances it is very difficult to plan the stay in Sweden, particularly the time schedule of the courses. In many occasions, courses are cancelled just a few days in advance, which means that the student has to wait sometime to the next year until the course is given again. In other cases, courses overlap with the student’s teaching or administrative activities in Nicaragua. Moreover, various students confront severe personal problems or have acquired professional commitments that make traveling very difficult. Under these circumstances, graduation becomes a very difficult challenge for these candidates. Moreover, **in some cases after 12 an 18 years of the initiated the bilateral program, no Ph.D. graduation has been achieved in some of the Universities** (see UNI report). Slow actions in

graduation may delay opportunities for young scientist working at the Nicaraguan Universities within the framework of the bilateral project.

Sticking to only one training model (e.g. sandwich model) is particularly difficult for females with children. This is further aggravated for single mothers. Given the family responsibilities, women are less prone to travel than men are, and therefore cannot go abroad for months to train and leave their family behind during this protracted period. It is more likely that female student confronts graduate training abroad by taking her family with her, than travelling back and forth and leaving her family behind. However, under this situation (getting academic training abroad), some countries are more amenable for women with children than others. Under these circumstances, gender differences sequentially accumulate and in the long run more males than females will take advantage of restricted graduate programs. The marked gender differences in Masters and Ph.D. training during the bilateral program, although may be the result of combined factors (e.g. differential selection and real opportunities), the restricted training alternatives in turn contribute to this difference.

Many groups have expressed their frustration regarding the absence of opportunities in some very important Nicaraguan problems. **Restricted training models also jeopardize initiatives for training in areas relevant for Nicaragua.** It is difficult to find a Swedish counterpart specialized in certain fields, mainly those specifically related to the tropics or to Nicaraguan idiosyncratic productive actions. In this respect relevant topics remain in a “limbo” within the Nicaraguan University priorities without support and training.

More than half of the students trained abroad recognized to have English language problems during their studies (see annex 12.8.1.). With no exception, the Swedish tutors recognized that most of the Nicaraguan students had major English language problems, and pinpointed difficulties in written and oral communication as the major handicaps that students presented during their training. A considerable number of Swedish tutors also alleged that students had insufficient academic level in some specific areas necessary to initiate research in Sweden and that most if not all of these deficiencies would be easier resolved in Nicaragua than in Sweden. Although this has been partially resolved in some instances, this factor still represents a serious practical problem to the training program supported by Sida/SAREC. Moreover, students without these essential requirements are constrained to very unfavorable circumstances in Sweden where they have to comfort new academic environment and a more competitive academic structure. At the end, this will be one of the main factors working against success and efficiency in graduate training.

Due to complex circumstances, most of them related to academic authority, opportunities and research interest, the commitment of the Swedish counterpart in training of the Nicaraguan students marks in a greater proportion the fate of the collaboration. Fortunately, a significant number of the Swedish counterparts has been strongly committed with the collaboration. However, **we have to be honest and recognize that some of the Swedish counterparts do not have the necessary commitment or interest to participate in this collaborative enterprise.** By itself, this is not wrong, is just reality. The genuine problem comes when this situation is not detected on time, or even worst, when it is tolerated and perpetuated (e.g. as reflection of lack of interest) with adverse outcomes for all parties. The words of one Nicaraguan Ph.D. student captured under this incident are quite explicit:

“When I arrived to Sweden I thought I could perform research in questions related to my MSc., however, I was assigned to something else not related to what I teach. Now, I am stuck. I don’t know what to do, because I have expended several years in this project with very little results. In Nicaragua we do not have the equipment for performing this kind of research. I have very little contact with my tutor... because of my duties here.”

As consequence, **several of the research projects do not maintain the adequate level of communication and enthusiasm** between Nicaraguan and Swedish individuals and institutions for them to be successful. Both, long-lasting students and Swedish tutors are prone to develop a stage of “extreme tolerance” and unhealthy dependence. In many cases this comes to a stage of equilibrium in which no clear decisions are taken. On the one hand tutors have the tendency to accept this situation, despite the fact that it is not commonly accepted within the framework of a graduate training in Sweden. On the other hand, dependence on the Swedish counterpart hampers the initiative of the student to make changes regarding his/her graduate training. A final consequence of the long lasting graduation is that experimental data may become obsolete and then difficult to publish and to include in the framework of a thesis.

4.2.4. Increasing links with society

One of the parameters used to evaluate success in scientific development is to determine the impact that the different research projects have in society. This, however, is a very complex fact not easy to detect. It is true that several projects supported by bilateral collaboration have explored different alternatives and some of them have established links with society, making relevant contributions [see sections 7 and 9; CNU 1999]. However, **the general view has been that the vinculum with public, popular and private sectors is still weak** [Behar and Lundahl 1994; see annex 12.15]. In most cases it has not been attained despite the fact that several of the main research project objectives are directed to improve the public health conditions, the efficiency of agroindustry or to interact with industry establishing links with the productive sector. Part of the problem reside not directly in the research groups or the relevance of the investigative enterprises but in the absence of intermediaries and intervening actions that could link research results and investigators with the society. The public Universities of Nicaragua, have expressed strong commitment in this direction [CNU 1999; see annex 12.15]. Nevertheless, the absence of resources and experience in establishing connections with the productive sector and the absence of facilitators that could reach those relevant social actors and make connections with research teams at the Universities, work against these initiatives.

5. Recommendations

The research collaboration between Sida/SAREC and the Nicaraguan Universities does not operate in the vacuum, but within distinctive social contexts. Similarly, the recommendations written in this study will not operate in isolation but as concerted enterprises of all the parties enrolled in the collaboration. The recommendations put forward for each party are constructions of the reality, only useful for stressing who has the major responsibility. However, understanding that this responsibility has to be shared in smaller or larger degree by the collaborating units, is necessary during the analysis. Furthermore, near, intermediate and long term recommendations are deep relativist concepts that can be translocated accordingly to the notions of temporality. **We considered near (short) term recommendations, those in which results may be seen in the lapse of 1–3 years, intermediate recommendations those in which objectives are obtained in the range of 3-5 years and long term those to be accomplished from 5 to 10 years.** Therefore organization of this section, constructed according to the Terms of Reference (see annex 12.5) should be subordinated to the recommendations themselves, rather than to the time span in which they are located.

Several of the recommendations developed here have been also pinpointed by the Nicaraguan Universities during different exercises and workshops (see annex 12.15.). The reader may find, however, that the suggestions indicated in this evaluation have been elaborated in more specific terms related to

the bilateral collaboration. Recommendations concerning each University are found in the annexes corresponding to the individual evaluations. We encourage the reader to review the recommendations made by the Nicaraguan institutions and compare them with the suggestions in this section.

5.1. Long term recommendations for Sida/SAREC

5.1.1. Efficiency and Sustainability

Taking into consideration the circumstances in which the Sida/SAREC collaboration initiated in Nicaragua, we have to say that what has been done in building research capacity in the public Nicaraguan Universities has been reasonably effective. Nevertheless, there is still a long way to run before efficiency and sustainability in research capacity is achieved by the Nicaraguan Universities. We are convinced of the convenience of maintaining the Sida/SAREC collaboration for long-term period in order to consolidate the efforts carried out for already 20 years of collaboration. With the continuous support of the bilateral cooperation, research projects, undergraduate and graduate activities very likely would evolve to a more advanced stage, necessary to approach the necessary independence and sustainability. **It is recommended that the economical support should be maintained or even increased at least for a ten-year period, mainly supporting those projects in which cooperation among different groups and different Universities is attained.** After this period, a review and evaluation of the objectives shall be made and Universities invited to submit a new proposal to Sida/SAREC. This proposal has to be based on the specific achievements obtained by the different research groups and investigators of the Universities, and also demonstrate that the groups assisted during the bilateral cooperation have gained a considerable degree of independence (for definition see section 7.4). The significant imputes in academic and economical terms and human power that Nicaraguan Universities will devote to their research programs during the collaboration should be determining factors in this proposal.

5.2. Near term recommendations for Sida/SAREC

5.2.1. The Research Teams and the projects

Although groups have achieved a certain level of maturity, they still require trained personnel and more research before becoming independent scientific teams (for definition see section 7.4). **We suggest that Sida/SAREC concentrates on the same projects it has supported in the last years.** The actual level of funds devoted to public Universities of Nicaragua does not allow dispersion of these funds in collateral or additional projects. The basic notion is that Sida/SAREC support to research in Nicaragua has been dispersed:

"Finally, the research assistance rendered by SAREC also presents a mixed picture. With only minor exceptions, what has actually been done has been done fairly well given the circumstances. However, concentration has been lacking, the funds and the efforts have been spread too thinly and the capacity-building aspect has not been stresses sufficiently." [Behar and Lundhal 1994].

The efficacy of the research projects is still far from being optimal and not homogeneous among the groups. Despite this, the relative significant advancement should not be interrupted or diminished. **If new projects are going to be financed, they have to be supported by additional funds.** This does not imply that the assigned funds to the current projects should not be negotiated on the basis to quantitative and qualitative parameters. **Efforts should be made in consolidating groups through education of young scientists as well as in the contribution of small competitive grants** [Allebeck and Nieto 1994], for those groups of investigators and individuals that have demonstrated research capacity. It is suggested that the Directions of Research (Vicerrectories, Deans of research, etc.) should develop the granting process. Grants given on the basis of written

proposals should be judged by a group of evaluators with qualified credentials (at least Ph.D.) and with the participation of international evaluators (e.g. from Sweden and/or from other foreign countries). This strategy would help the Ph.D. graduates to be reincorporated in her/his academic unit and to encourage training for writing grants. **Renewal of grants should be made on the basis of results and competence.**

5.2.2. Training Models

The (open) “sandwich” model has reached a critical point and changes are required.

We consider mandatory that both, the Swedish and the Nicaraguan counterparts re-evaluate and discuss their activities and possibilities, based in reality and chances of success. As pointed out above, graduation for several of the candidates is becoming extremely difficult, and chances of success are very low for some of them. Furthermore, considering that some of these senior graduate students are already consolidated academics at the Nicaraguan Universities, who are working in or leading research groups, their absence may cause more problems than benefits to the system. **Both parties must consider retiring some of the senior students enrolled in graduate training in Sweden and give chance to a new generation** who has been trained under more favorable circumstances in the research groups supported by Sida/SAREC. In this respect, the first generation of investigators under the bilateral collaboration and the Program for Biomedical Research and Training in Central America [Nieto 1996], understood well the need of possessing good basic academic training and adequate knowledge in English language. The existence of research groups and trained investigators in Nicaragua that could now serve as counterparts favors the development of a closed “sandwich” model, possessing clear advantages over the present model as discussed previously.

In addition to the “sandwich” modality, diversification and finding other alternatives for training is necessary. For some students the sandwich model may be particularly difficult (e. g. single women with children). For some students with interest in tropical diseases, the sandwich model may not represent a particular advantage if there is not a qualified tutor in Sweden, unless is combined with a third country (triangulation) possessing the indicated experience. Support for graduate training in Central America or in other Latin American countries is recommended, mainly when expertise (and then a tutor) can not be identified in Sweden. Training in a third country may increase the chances of graduation and reduce the expenses (compared to Sweden). We understand that this is a controversial and delicate issue, because Swedish taxpayers expect that the Sida/SAREC funds devoted to Nicaragua will not be deviated. However, this controversy could be alleviated if some of the third countries taken into consideration belong to the same region or to countries supported by international Swedish aid. The recent Central American regional Ph.D. program based in the Swedish model may represent a practical and constructive alternative [<http://cariari.ucr.ac.cr>]. Very rewarding and positive experiences in this direction were obtained in previous programs supported by Sweden [Nieto 1996; <http://www.NeTropica.org>]. It will be relevant that Sida/SAREC, in consortium with the Nicaraguan Universities, make a careful evaluation of the alternatives.

5.2.3. Symmetry and Collaboration

The perception of a number of investigators “that relationships between both parties have not been symmetrical” and “that information has not been always clear-cut”, deserves attention. Valid or not, it is important to take these opinions into consideration and to clarify the motives and the direction of the Sida/SAREC cooperation in the future. It is important that all information is distributed at the various academic strata. Careful planning and step-wise measures are necessary when changing the Swedish personnel committed to the bilateral cooperation.

Sida/SAREC (as well as the Nicaraguan Universities) should be aware that **some of the Swedish counterparts are not suitable for the collaboration** and that to include them as counterparts may force the situation to inefficiency and chronic stages of equilibrium without accomplishment of results. As the Sida/SAREC program has developed from support to individual students to development of research capacity/environment, **the Swedish counterpart also needs to develop their perception of the cooperation.** For the Nicaraguans it is very difficult to determine and prevent this situation *a priori*, just by looking the academic credentials of the tutor and the Swedish institution. In this respect, Sida/SAREC must increase its activities in promoting close contacts between both parties before initiating collaborative projects or bringing students to Sweden (as in the case of UNFM students; see section 8). **During the first months, interviews with the Nicaraguan and the Swedish counterparts must be carried out to detect problems as early as possible.** It may be that the bigger and more competitive Swedish research groups do not represent the most adequate substratum for most of the Nicaraguan students. These highly successful groups, also seductive from the intellectual point of view, may be too committed to their specific activities with very little time. It may be that medium size or smaller research groups are more suitable for newcomers who would require a more “favorable” environment. From this point of view **it would be advisable for both Sida/SAREC and the Nicaraguan Universities, to have a list of the more feasible and suitable tutors and institutions willing to participate in the bilateral collaboration with Nicaragua.** This alternative does not rule out that some Nicaraguan students or postdoctoral candidates could carry out training within very competitive research environments. Examples of successful enterprises carried out in this direction with strong commitment of Swedish counterparts and institutions are found in the KIRT programs in collaboration with the Central American Universities [Nieto 1996; <http://NeTropica.org>].

5.2.4. The Courses

As stated before the Sandwich model may be problematic at the time of taking courses in Sweden, due to that several of the graduate courses are not offered on a regular basis (see section 10). At least for the basic courses, **a schedule should be agreed upon when the student enters the program.** After completing the basic courses, the student should be encouraged to choose/have the possibility to select courses at other universities in Sweden or abroad. It is important to realize that many of the academic time schedules established by the assigned Swedish institution may not be compatible with the Nicaraguan time schedule alternatives under the sandwich model. **Mixed courses between Nicaraguan and Swedish tutors performed in Nicaragua should be estimated as real options.** These kinds of enterprises were highly successful as demonstrated in graduate courses performed between Central American and Swedish professors in Nicaragua [Nieto 1996; <http://www.NeTropica.org>].

5.3. Intermediate and long-term recommendations for Nicaraguan Universities

5.3.1. Administration of Research Activities

The Universities should improve the University administrative system devoted to research activities in order to facilitate the advancement of science. Public Universities of Nicaragua should concede that time devoted to research is a legitimate academic activity that requires official recognition by the university administration. Although this has been a constant concern of University authorities, the reality is that the Nicaraguan Universities have not resolved this problem. Experiences in other Latin American countries have demonstrated that **official recognition of research activities at the same level of teaching, administration and extension** increases all activities improving the quality of the University at various levels.

Most Universities have not implemented a efficient office devoted to the promotion of science for a coherent and centralized administration of research activities (e.g. Vicerrectory of Research). In addition, **it is mandatory to settle a University Research Council with interdisciplinary participation, bringing together Faculties, Departments and research groups.** The duties of this Research Council would be the identification of research priorities and clear-cut commitments for the promotion of science. By this manner scientific activities would be more independent and less susceptible to unfavorable and unpredictable political changes. One of the **goals shall be the modernization of academic activities linking them to research and to set goals for the long-term development**, both for the undergraduate and graduate study programs. In this direction Nicaraguan Universities have already elaborated plans that serve as a framework for real recognition and future development of research activities [UNI 2001; Medina et al., 1997]. Similarly the discourse of University authorities is evolving towards direct actions:

“These (scientific) works are the culmination of a motivation and acceptance phase that embrace research as a primordial enterprise of University’s activity... We know that these achievements are the result of a major effort performed under adverse conditions. There are not clear political definitions orienting research, resources are scarce and there is little interest of those designing policies... I have confidence that this scientific publication would accomplish its main objective that is to demonstrate that with effort and determination is possible to perform high quality research in our country and that investment in scientific development is the best investment for the future of Nicaragua”. [UNAN-Leon 2000]

Plans and the **official recognition of research activities should be reflected in concise and specific credits and privileges** and be part of a concerted system between the research groups, the Faculties, Departments and the Directions of Research. There is therefore an urgent need to define strategies that allow the University to increase salary levels and to develop incentives making research an attractive option. Such a system could include salary incentives for researchers based on efficiency, numbers of published papers, thesis supervision, working hours and academic status. Other incentives would be allowing postdoctoral training abroad, sabbatical leaves and access to competitive research funds and release from administrative duties and from excessive teaching. Three options that could partially finance such a system may be developed: consultancy services, involvement in research-based economical enterprises (see below) and assembling granting processes. Official recognition of research activities would also allow the creation of Research Centers and Institutes that would bring together scientists. It is advisable in this process to incorporate the Departments and Faculties, in order to maintain the links between quality of teaching and scientific activities. Sida/SAREC could facilitate this process by promoting training of University Academic authorities (e. g. Deans, Directors and Coordinators) in higher educational programs and fund raising.

5.3.2. Research as a Professional Activity

Projects capable of generating funds through economical activities related to research should be supported. Among these are diagnosis of infectious diseases, chemical analysis, detection of contaminants, relevant epidemiological and demographical information, watering systems and consultancy. The logic behind these activities is that the earnings could be reinvested in the projects. All successful Universities in the world have strong links with industry and trade services without detriment of research or academic activities or loss of social impact of the Universities in the community [IVA/VINNOVA 2002]. This does not mean that everybody at the University has to be involved in selling services; this is a complementary action among different alternatives. At the same time that these activities are encouraged, Universities can carefully make plans to regulate these activities, which in good terms, they do not depart from University main objectives and priorities [Niemeyer, H. H. 1997]. Examples of successful enterprises are seen at all levels in the Swedish academic institutions [IVA/VINNOVA 2002] and in several Latin American countries [Fundacion UNA. 2000].

As stated previously, one of the major drawbacks detected at the Universities is the tendency of enlisted students or new Ph.D. graduates to perform administrative positions and to be enrolled in dense teaching programs. It is wise that **during training abroad the teaching should be limited** to one course/semester per year. Administrative work and appointments (e.g. as Dean of Faculty or University Rector) should not be combined with the Sida/SAREC training project. This should be jointly agreed upon each enrolled student and the Nicaraguan Faculty and hopefully by a general (written) agreement at University level for all students, as it is in the interest of all parties to reduce the time spent in the training program.

5.3.3. Research activities and Society

One of the main concerns of all Nicaraguan Universities (see annex 12.15.) and also expressed in a general evaluation performed by the Secretariat for Analysis of Swedish Development Assistance [Behar and Lundahl 1994] refers to the impact of research activities in the Nicaraguan society.

Universities should make joint efforts in working together with different institutional actors such as government, universities, firms, producers associations, non-governmental organizations and grassroots organizations. Universities should organize workshops by sector, involving the whole range of stakeholders in order to create a common language, build coalition and foster linkages.

Opening basic courses and problem oriented talks directed to specific social groups in which scientific achievements are demonstrated in simple and comprehensible form for all stakeholders. Initiate regular joint publications in the form of brochures and small pamphlets accessible for all, even for those with very low educational level. **This should not be an individual effort but a concerted effort of all public Nicaraguan Universities in collaboration with the various communities.**

Unfortunately, there are not functional and concerted governmental systems in Nicaragua that could serve as facilitators for establishing this kind of links. Therefore, public Universities through their extension programs should develop their own projects for linking research results with society. In addition, **Sida/SAREC could encourage linking of research projects supported in the bilateral program and other projects also supported by Sida in Nicaragua.** The different parties should take advantages of these structures. Excellent examples of how to perform these enterprises are found in Central America and in Latin America [<http://www.icp.ucr.ac.cr>; Fundación UNA 2000; Niemeyer, 1997; Texeira and Benchimol 1993].

5.3.4. Networking

Networking among the different institutions to encourage and facilitate science and technology development, was one of the main recommendations put forward by the Nicaraguan Universities (see annex 12.15.). We are convinced of the importance of this recommendation and **encourage the various Universities to exchange experiences regarding the research projects and procure joint activities in common areas** of interest as well as in teaching enterprises. By this, the opportunities to resolve scientific questions and the quality of teaching will increase. In order to join efforts and optimize the academic training, Universities could organize common Master's programs with the participation of MSc. and Ph.D. graduates from the four Universities. This kind of activities may increase opportunities for students to perform thesis work and may open an excellent forum for the exchange of ideas and for establishing collaborations. Joint academic enterprises will be the starting point for initiating research collaborations. Sida/SAREC could assign small funds for networking in the direction proposed.

Concomitantly to these actions, Universities should expand their network activities in library information regarding research journals, books and periodical information. Joint meetings among the various University librarians and researchers will be very constructive activities frequently leading to the specific solutions for the research groups.

5.3.5. Equipment for Research

Another aspect related to networking is the **development of joint plans for replacement and maintenance of equipment**. It is strongly recommended to give priority to the improvement of the laboratory conditions based on research capabilities and trained personnel in all Universities. A concerted effort in the maintenance and repairing of equipment carried out by all Universities must prevail over individual ventures. The rationale for this recommendation rests in the expenses of bringing various experts for repairing specialized equipment. **The culture of preventive maintenance of equipment has to be incorporated in all Universities**. Assistance of UNI to other Universities may be a constructive venture for initiating collaborations and specific links between those projects supported by Sida/SAREC in UNI and the projects in natural sciences subscribed in the other Nicaraguan public Universities. Fixing and repairing scientific equipment could also be the initiation of a research-based economical activity by UNI as demonstrated by other Engineering Universities in Latin America [<http://www.cicr.co.cr>]. Additional funds for repairing equipment shall be obtained through the application of specific grants for this purpose [<http://www.ictp.trieste.it/TWAS/>].

An inventory of the equipment at public Universities of Nicaragua purchased through the Sida/SAREC cooperation agreement should be made. This catalogue should include the specifications of the equipment and the actual functioning status. Based on this, **a careful plan for repairing, maintenance and renewal of equipment must be developed in collaboration with Sida/SAREC**. The different research groups, Faculties and the Directions of research may coordinate this. At least one qualified specialized electrical engineer must be responsible for laboratory equipment on a routine basis. In the same direction, purchase of equipment must proceed to the presence of trained personnel as well as the research groups capable of using these equipments [Thulstrup 1996]. That is, not to purchase equipment before the arrival of trained individuals capable of using it, and to be certain that the purchased equipment fits the circumstances to work under Nicaraguan conditions. Generally, mechanical based technologies present less problem for repairing in low income countries than high tech digital systems.

One of the current practical problems confronted by all Nicaraguan Universities is retrieving of equipment and materials from the custom office. Again, all Universities confront this common problem and then solutions should come from joint efforts. **It is necessary to establish common routines and strategies for retrieving equipment, reagents and materials in the most favorable conditions**. It is advisable to centralize in one specialized unit the efforts in order to save resources and concentrate energy and funds. Sweden as international mission in Nicaragua could facilitate all these processes.

5.3.6. Gender Balance

With the exception of UNAN-Leon and UNAN-Managua, the other two Nicaraguan Universities maintain a disproportionate higher number of male graduate and undergraduate students and researchers in relation to females (see annex 12.7.4.). This gender unbalance is the consequence of complex social, cultural and psychological circumstances with no simple solutions. **The first stage in solving this gender difference is to recognize its existence**. Clear opportunities for learning English language and for level academic background may diminish the difference, mainly when female candidates have children. As stated previously, **diversifying the training models would be an alternative for women to choose which model fits better to their conditions**. Considering this, Sida/SAREC may contemplate the possibility of complementary budget for women with children studying abroad.

5.4. Near-term recommendations for Nicaraguan Universities

5.4.1. Planning

Universities of Nicaragua should develop clear-cut strategies for the selection of Swedish tutors and working places. These strategies shall be made on the basis of visits, experience, specific interests and commitments. **It is mandatory joint planning between Nicaraguan and Swedish institutions.** These joint enterprises should be made on the basis of real achievements and taking into account the failures. Frankness and decisions supported on real experiences is mandatory. Both parties should consider differences in graduate requirements. As stated before, Nicaraguan Universities should identify as much as possible those Swedish institutions that fit better their expectations. Changing tutor or rejection of a graduate student should be estimated as a realistic and practical solution, rather than a traumatic action. Relationships between students and tutors should be understood as academic experiences rather than conditional interactions. **Identification of Swedish counterparts committed with the bilateral cooperation and demonstrating significant comparative advantages for the Nicaraguan counterpart is mandatory for achieving efficiency in the collaboration.** In this respect it is important that students and tutors as well as the institutions participating in the bilateral cooperation make commitments and establish conditions and clear cut rules to secure that the efforts done by the various parties are not wasted.

5.4.2. Academic background

There is no doubt that deficient academic background and deficient knowledge of English language work against efficient training. Besides satisfactory academic background, student candidates must demonstrate an adequate knowledge of the English language (written and conversational) before being accepted as graduate students in Sweden. International exams such as TOEFEL, Michigan and/or British Council evaluations could serve as parameters. **There is no justification for avoiding the use of international parameters that have served for decades to select students for scientific training abroad** (Educational Testing Service, P.O. CN 6151, Princeton, NJ, USA). Candidates who do not demonstrate the adequate knowledge in English must not be accepted in the program. Similarly, prior to the initiation of studies in Sweden (from six months to one year), candidates must request information to the Swedish institution regarding the basic academic requirements. If necessary students shall take specific academic courses in Nicaragua or in the region to level up hers/his academic background to the standards required by the Swedish institute. The Swedish counterpart should actively participate in this process, suggesting those courses necessary prior to the initiation of studies in Sweden. This could be done by consorted bilateral agreements. **If courses for leveling academic background are not offered in Nicaragua, they may be taken in other Central or Latin American country**, as they normally are less costly and troublesome than coursing them in Sweden.

5.4.3. Coordination and Monitoring of the Program

Experiences have demonstrated that **“sandwich” training models are more efficient when there is a local coordinator and a group of local tutors responsible for the students**, research activities and administrative matters related to the cooperation [Nieto 1996; <http://www.NeTroopica.org>]. If there is no local tutor for a closed “sandwich” alternative, then the local coordinator plays a very important role in the follow-up of activities and communication with Sida/SAREC and Swedish counterparts. Although some Nicaraguan Universities have taken important steps in establishing local and Swedish coordinators with common roles (see section 9), this has not been the general outcome among all Institutions. In addition, the **Nicaraguan Universities may consider assigning one general coordinator, holding enough power, that could serve as counterpart to the Sida/SAREC coordinator** (e.g. in this case, the CA coordinator will be the

counterpart of the Swedish country secretary). Once each University appointed a local coordinator, then a board of counterparts may be established, assigning one chairman chosen among the group. That is, there will be 4 counterparts (one for each University), and one of them will function as a chairman of the group. The local coordinator(s) should accomplish several requirements, among them to have an extensive command of the English language, be well versed on the bilateral program, be acquainted in scientific subjects, have extensive access to internet, facsimile and phone, be assigned full or 1/2 time and have an assistant.

Permanent strategies for the internal and external monitoring of the bilateral cooperation must be developed to a larger extent. Moreover, **a culture of preventive management has to be implemented in all the cooperation actions.** By this, future problems emerging during the bilateral collaboration could be prevented by the development of monitoring systems that would detect possible difficulties before their emergence. This monitoring systems developed by the Universities should function permanently during the collaboration. Monitoring systems are more efficiently implemented by a local coordinator(s), as suggested in previous paragraphs. Differences in coordination and monitoring of the bilateral collaboration have been detected among the various Universities, and the reader is referred to the individual evaluations to determine the magnitude of our recommendations.

5.4.4. Comparative Advantages

It is mandatory that the research groups of public Universities of Nicaragua identify their comparative advantages with respect to other countries, and establish priorities based on these advantages. A turn on of the unfortunate circumstances may convert these conditions in comparative advantages. It is necessary that research groups systematize the information making these data interesting and valuable for international groups as well as private and public enterprises to participate. Comparative advantages are found everywhere, but they require interdisciplinary research in order to detect and present them as coherent enterprises. Accordingly, the Directions of Research of the Universities of Nicaragua in collaboration with Sida/SAREC may play a catalytic role for the identification of comparative advantages and for establishing advantageous and successful collaborations. As pointed out before, many good examples for obtaining benefits of comparative advantages are found elsewhere [Fundacion UNA 2000; Mata 2000; Moreno 2000; Texeira, and Benchimol 1993].

5.5. Intermediate and long term recommendations for both, Sida/SAREC and Universities.

5.5.1. Consolidation of Research Councils

The Directions (Vicerrectories) of research should be reinforced and invested with more power in order to consolidate the efforts of these administrative units. The experiences achieved by other Latin American Universities in the last 30 years, indicate that **strong University Research Councils within the University are more efficient in promoting scientific and academic activities than national councils for research** [Moreno 2000]. The Deans for Research must achieve expertise in fund raising, higher education and in management of research funds. In this sense, Sida/SAREC could contribute to these offices with dawn funds for grants as well as for short-training and traveling for scientific purposes. Sida/SAREC in collaboration with the Nicaraguan Universities and Swedish counterparts could participate in the further development of a University Research Council. This office could help to establish research priorities and objectives, make institutional plans and take decisions based on quality and proficiency of the research groups. The promotion of University joint projects through shared grants is one example of how Universities and Sida/SAREC could encourage cooperation and contacts among the different research groups.

5.5.2. Fund Raising and Strategic Alliances

Assistance by Sida/SAREC in the art of fund raising and in the identification of international funding agencies and relevant non-governmental organizations is mandatory.

Training has to be carried out at all levels (institutional, Faculties, Departments, research groups and the investigators). Fellowships for investigators to learn in third countries the art of fund raising (e. g. from successful researchers) would be a major contribution towards sustainability. Examples of very successful research groups in fund raising are found in Latin American countries such Mexico, Brazil, Costa Rica, Uruguay and Chile. For Nicaraguan researchers the Latin American groups may represent a better alternative since the topics, circumstances, comparative advantages and drawbacks are similar. However, this does not exclude learning in other countries. Moreover, in addition to specific scientific and technical activities performed in Sweden during graduate studies, fund-raising activities could be incorporated as part of the academic curricula. Alternatively, practical fund-raising courses (culminating with research proposals ready to be submitted) could be organized in Nicaragua on a regular basis. The benefits of these exercises have been demonstrated elsewhere [<http://www.tgci.com/>].

It is necessary to form critical alliances with institutions, laboratories and individuals for increasing the quality of projects and funding opportunities. **Sida/SAREC collaboration may be presented as counterpart for alliances with relevant contacts.** Stimulation of joint research projects with first class laboratories, with non-governmental organizations and with members of the productive system is essential for long term sustainability of research activities. Sida/SAREC may encourage these alliances by supporting tripartite collaborations between Swedish institutions, Nicaraguan laboratories and a third country (e. g from the region or from Latin America). Sida/SAREC could bring together different programs supported by Sweden in other countries. For instance, it would be of great interest to support collaborative projects between Nicaragua and Honduras with the participation of a Swedish institution. These three laboratories could make alliances with other European laboratories and submit applications to the European Community (e.g. RTF actions). Sida/SAREC could proportionate to the Directions of research some small funds for bringing the different groups together for planning.

Institutional plans (e. g. fellowships for attending conferences, visiting laboratories etc.) for promoting local and international collaborations must be undertaken (e.g. exchange of scientists supported by TWAS). Funds for coordinating this kind of activities may be managed by the Directions of Research. Graduate training within Central America or Latin America would increase the contacts between researchers in the region. The Directions of Research in coordination with the Faculties, Departments and research groups should be aware and distribute information regarding international fellowships, grant opportunities, training courses and academic activities performed abroad. Training in this area is required. Swedish Universities and Swedish research institutes are very efficient in promoting these enterprises. In this sense Sida/SAREC could also contribute by facilitating information regarding other programs supported by Sweden, and if possible, to facilitate links with Sida/SAREC activities performed in different countries.

5.5.3. Reinforcing Facilities for Research

Sida/SAREC has greatly contributed to the reinforcement of the library, acquisition of equipment and administration of funds in the Nicaraguan Universities. This kind of assistance must be maintained, however, the emphasis must change and the contribution of Sida/SAREC needs to be reemphasize in certain areas. For instance, although additional training in basic library routines is not required, **further training of library employees in modern strategies for obtaining information through Internet and CD-ROMs is mandatory.** Libraries require specialized personnel for searching in exact sciences. It is recommended to train at least one person in each University that could

perform searches of scientific periodicals and retrieve specific information for the investigators. CD-ROMs and electronic versions must substitute journal hard copies. This person must be also trained in networking for establishing connections with free journal sites (e.g. <http://www.freemedicaljournals.com/>). Optimization of the system will allow more subscriptions for less money. The Internet facilities must be adjusted in order to achieve higher speed. It is necessary to develop centralized library computer systems among the different Universities. Additional Sida/SAREC funds for the modernization of equipment and training will be necessary. The Universities may elaborate a specific proposal in this direction.

Additional assistance in the simplification of routines for disbursement of funds, purchasing of equipment and materials is required. Routines must improve as indicated [KPMG Peat Marwick Nicaragua 1999]. Training of personnel in some of the Latin American institutions (e.g. Foundations) for the management of funds, purchasing and dealing with customs is recommended. A concerted effort among the different Universities with the assistance of Sida/SAREC is mandatory for resolving these significant bottlenecks for research development.

6. Lessons learned and general comments

The overall picture of the Sida/SAREC assistance to public Universities of Nicaragua is portrayed by a combined set of findings. Depending on the parameters used to judge these findings different conclusions can be drawn. As stated before, if we judge the scientific achievements of the public Nicaraguan Universities with the same parameters used to evaluate the performances in developed countries (e.g. ISI impact factor, patents, research grants etc.), then the efficiency reached by the Swedish assistance to these institutions has been low. Although, at first glance this may be a valid alternative, we strongly believe that this is not the correct perspective to judge the Swedish collaboration. Given the actual state of affairs and the experience accumulated during this study, the obvious and more relevant lesson learned is that **the achievements of the Universities of Nicaragua on research development should be judged on the grounds of the initial circumstances in which the Sida/SAREC collaboration started.** Under this perspective and repeating what we said before, the cooperation has been fruitful and important, but so far not concluded.

We have pinpointed old and new problems and written down suggestions that could be used to improve the bilateral collaboration between Sida/SAREC and the Nicaraguan Universities. Our criticisms are not intended to please but to convince. In this sense they mean to be constructive, despite the fact that in occasions they may be perceived as hoarse comments. **In some cases we suggest urgent adjustments of attitudes, procedures and strategies; while in others we recommend devising new solutions to new and old problems. Although we have learned that several of the problems indicated have been partially solved, we have insisted on them on the grounds of their importance for the collaboration.** This also means that we understand that the magnitude of the problems have changed with time. In this direction we have also learned that public Universities of Nicaragua have reached a more mature position with respect to previous years, and now they are capable of perceiving with more clarity the relevance of research enterprises in the context of academic activities; but they still need support.

The impact that the positive outcomes may have for the future would greatly depend on how both parties enrolled in the bilateral collaboration adapt to the current situation and the strategies to resolve individual and common problems. At this point, the cooperation is in a new phase and requires adjustments and a few substantial changes. **Many of the necessary changes for achieving**

higher efficiency in the bilateral cooperation do not require additional funds but strategically qualitative modifications and dialogue. We envision that higher efficiency could be achieved within the following 5 years. Sustainability is a slow condition that depends on many factors, among them efficiency, critical mass, alliances, aspirations, opportunities and independence by the research groups.

Some of the decisions and priorities established by Sida/SAREC have been modified in time. This is understandable and even may be advantageous. However, it must be taken into consideration that many of the participating personnel at Universities of Nicaragua and Sweden have remained constant during all these years and in consequence perceive some of the Sida/SAREC “new” decisions as contradictions, in the light of previous agreements. Frequent dialogue and joint planning is required. Keeping the same official responsible for the Sida/SAREC bilateral collaboration with Nicaragua has brought several advantages in the functioning and implementation of programs and projects as well as in the understanding of both counterparts.

Our experiences suggest to us that the Sida/SAREC coordinator should be kept for a protracted period. Transitions of personnel involved in the coordination of the bilateral collaboration should not be abrupt, but stepwise.

A very important lesson learned concerns to the Swedish counterpart. Despite the weakness of the Nicaraguan counterpart, **if the Swedish counterpart is strongly committed and actively participates in the collaboration, then the chances for success are high.** Success in this context is not necessary a synonymous of graduation, but learning and involvement in research activities when returning to Nicaragua. Then, the selection of the Swedish counterpart and the topic of research have been two of the more critical aspects during bilateral collaboration. The topic of research has to be interesting for both, the Nicaraguan student and the Swedish tutor, otherwise attention and good purposes would be lost. In this respect it is important that the topic investigated by the student is also within the research interest and expertise of the Swedish laboratory and not only to the Nicaraguan counterpart. It is better and more educational for a Nicaraguan student to investigate an “exotic” Swedish problem with good guidance of the Swedish tutor, than to study a local Nicaraguan problem with little or no attention of the Swedish professor. Linked to this, it is required to establish clear-cut rules and deadlines for research activities and graduate studies.

Through clear-cut interviews with the Swedish and Nicaraguan counterparts, academic training of a significant number of individuals is very often considered synonymous of building research capacity and establishing a critical mass of investigators. Although the former process is the most important, and in consequence linked to the later two processes, research capacity and the concomitant founding of a critical mass of investigators represent a much more complex puzzle. This is even more aggravated in low income countries such as Nicaragua. It is clear that a lot of effort has been put in the specific academic instruction of the Nicaraguan students. However, **little or no expertise has been gained in granting processes, in strategies for writing research proposals or for the elaboration of scientific reports; nor for obtaining better opportunities and establishing interactions and collaborations.** Without these elements, academic training fades out and the potential of building research capacity is delayed. Albeit the arguments of some Swedish and Nicaraguan investigators, the truth is that very few scientific reports in peer review international journals have been signed by Nicaraguan investigators as corresponding authors, or have been submitted by research groups or investigators independent from Swedish counterparts. [ISI, Philadelphia, USA CD-ROM, 2001]. Moreover, very few local research proposals and local collaborations have been elaborated and submitted and even less international enterprises were detected (see above). Some of these problems may be idiosyncratic, but others seem to reflect the

dynamics of the training programs in Sweden. Whatever the case, the important issue is to understand that **Nicaraguan graduates require more than just specific scientific knowledge to be successful in a very aggressive and painful environment for performing science, as is the case in Nicaragua.** This is a very difficult task that must be attacked if success in building long-lasting research capacity in Nicaragua is envisioned.

We have experienced that research activities at the public Universities of Nicaragua are very sensitive and a lack of support from Sida/SAREC would be detrimental. The sustainability and consolidation of the cooperation will depend upon, not only in the quality of the research and academic activities performed, but also in the ability to be competent and competitive, and to capture the attention of the various agencies in order to diversify the funding sources. **The acquisition of international funds should be one of the main goals of the projects supported by Sida/SAREC.** Investigators should use the comparative scientific advantages of their country, establish efficient alliances and then apply for grant money.

To build up research based on comparative advantage requires a high level of concentration. **Trying to be strong in every field of research is difficult and dilutes efforts** (see section 9.2.2.3.2). In this sense it is better to concentrate efforts in a few research fields that could be used as comparative advantages for grant application. In this respect Sida/SAREC plays an important role restricting its long-term assistance to specific research fields, however it should pay more attention to fund raising activities performed by the Nicaraguan Universities, mainly in those fields related to the collaboration.

Cooperation among scientists and groups with similar interests and academic training must prevail at the Nicaraguan Universities where the number of trained individuals and the material resources for research are scarce. **With a few exceptions groups and investigators are reluctant to be involved in common enterprises with their colleagues.** Strategic alliances within the public Universities of Nicaragua context are as important as those achieved abroad.

The Directions of Research in Latin American Universities have successfully promoted science. The fact that some of the public Universities of Nicaragua decided to encourage research through an office (Vicerrectory) linked to the Rectory, demonstrates that science is a relevant activity for the University. In this respect, Sida/SAREC has played a positive influential role, which should be maintained. **The next step is that public Universities of Nicaragua recognizes research as an official enterprise.** It is important that this recognition would not be delayed, and approved as soon as possible. The multiple examples from other countries similar to Nicaragua that have successfully taken these steps several decades ago, should persuade University authorities, academics and administrators that these are essential measures for the advancement of science and academic activities at the public Universities.

Standards for evaluating research activities are indispensable operations for the qualitative improvement of research and selection of students. Unfortunately these practices are barely observed in Universities. Although the different researchers at the public Universities of Nicaragua accept that constant evaluation and criticisms are current and normal procedures in science, these practices need to be performed on a routine basis at the various levels: from research groups to students. **Both internal and external evaluations are required at different academic levels.** International standards need to be incorporated (step by step) on a routine basis.

The advancement of science in public Universities of Nicaragua do not depend exclusively on the investigators, but also on the context where research is been developed. In this sense both public Universities of Nicaragua and Sida/SAREC clearly understood that improvements of the Library, implementation of routines in the management of funds and development of research administration

are important factors for research to flourish. These activities must continue and further development. Other practices, mainly those related to fund raising, granting, information and publishing are scarce and require an additional effort.

We understand the advantages and benefits of the “sandwich” model; however, it is also necessary to understand its limitations, mainly of the “open” model. In the long run and under the Nicaraguan circumstances this model favors the accumulation of “senior” students in a “waiting list”. This causes low benefits for all parties, and then, **alternative training models must be balanced and considered in an idiosyncratic manner**, depending on the circumstances. For instance, the sandwich model works particularly well for single young students with no administrative commitments. On the contrary, for females with children, and on top local family duties, the sandwich model is very problematic. Between these two extremes there are various alternatives. However the sandwich model seems to be better adapted for married males than for married females. In addition, the open “sandwich” modality may limit opportunities for intense training within an adequate research environment and also hamper certain abilities such as writing papers and research proposals in close contact with professors and other graduate students. These last considerations should alert for restricting training to a single alternative.

We have learned that **identification of individuals, groups and research topics should precede other activities** such as the initiation of training programs and equipment purchase [Thulstrup 1996]. Indeed, no equipment purchase should be supported without clear-cut plans demonstrating the presence of scientific groups capable of taking optimal advantage of these devices. It is also relevant to establish priorities when purchasing equipment. Equipment purchase has to be done first on the requirements of the various groups, second on research teams needs and third on individual exigencies. Similarly, **no educational projects should be opened if there are no clear-cut candidates with the adequate academic training and English knowledge**. Sticking to these straightforward rules not only save time and money, but also increases the confidence of the participants. At the same time facilitate the process for candidates to level up their academic performance. If necessary, neighbor countries should be used that are familiar with the Nicaraguan idiosyncrasy and are committed to help. Every single request to Sida/SAREC should be done through a well-written and well-elaborated sound proposal, justifying in detail the requirements. The Nicaraguan counterparts must participate actively in the elaboration and writing of these proposals, and Swedish groups must be committed with Nicaraguan goals. As a final lesson we have to say that **for success in research enterprises in Nicaragua the culture of writing proposals, research grants and self-reliant manuscripts for publication must be incorporated on a routine basis**. Preventive management and optimization of funds is an essential part of every single collaborative activity.

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7. UNAN-Leon evaluation report

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7.1. Scope (UNAN-Leon)

The Autonomous National University of Leon Nicaragua (UNAN-Leon) was created in 1812 by the royal decree of Cádiz. The UNAN-Leon is the second oldest University in Central America (the first is the University of San Carlos, Guatemala) and the last University founded in the American Continent by Spain during colonial times. This University was one of the most important academic centers during XVIII and earliest XIX centuries in Latin America concentrating an important number of intellectuals. The main and also the most antique University campus is located in the center of this small colonial city of Leon. The academic life of the University is linked to the every day life in Leon, facilitating the links between the academics of this ancient institution and other social groups. The inhabitants of Leon are proud of their University, which represents one of the most valuable institutions of the Republic of Nicaragua.

After the Sandinista Revolution in the earliest eighties, far-reaching social and educational reforms were implemented, facilitating the access of Nicaraguans to higher education. After a Swedish mission visited UNA-Leon in 1980, the research cooperation with this institution initiated on a small scale in 1881. The goal was to strengthen higher education and research in UNAN-Leon. The "sandwich model" of training MSc. and Ph.D. was implemented with its first Swedish academic partner, the Karolinska Institute through the Research and Training educational program (KIRT). The collaboration initiated with training of MSc. in Microbiology and Parasitology and Social Medicine with a few pilot projects on infectious and parasitic diseases as well as in mining conditions. In later years, additional projects in reproductive and child health, mental health, occupational and environmental health and bacterial antigens were incorporated to the collaboration. In 1988, several UNAN-Leon academics were enrolled in the Graduate Program in Biomedical Sciences between the Central American Universities and the Karolinska Institute (Central American-KIRT). This regional program supported by SAREC, also based in a closed-"sandwich" modality concluded in 1998. From 1999 to 2002, four UNAN-Leon academics collaborating in the bilateral program are also supported by grants from the Network for Research and Training in Tropical Diseases in Central America (NeTropica), assisted by Sida/SAREC.

The present study is an initiative of Sida/SAREC to evaluate the public National Universities of Nicaragua after 20-years of collaboration. In May 2001, I was assigned to evaluate several projects supported by Sida/SAREC within Public Health Program and the Infectious Disease Program: Reproductive and Child Health, Mental Health, Occupational Health, Infant Diarrhea, Parasitic Infections, Antimicrobial Resistance and Bacterial Antigens. In addition I evaluated those instances receiving funds form Sida/SAREC for supporting research activities in UNAN-Leon such as the Library and the administration linked to research. Although I have revised and taken into account the Swedish assistance to UNAN-Leon for the last 20 years, this evaluation is engaged in determining the present situation and pays attention to prospective actions as stated in the Terms of Reference, rather than to describe the collaboration in restricted historical terms. I have concentrated mainly in the research projects activities, efficiency of training efficacy of the collaboration between the Swedish and the UNAN-Leon counterparts and in the viability and sustainability of the projects performed within the academic context UNAN-Leon. In this respect my report concentrates in current achievements and problems rather than in past actions. More general and detailed perspectives regarding the complexities

of the Nicaraguan public University System are found in the general evaluation were this study inserts. For those interested in the historical development, and perspectives of the Swedish cooperation with UNAN-Leon, I recommend revising the works of Allbeck and Nieto [1994], Ganuza [1988], Nieto [1996] and Sida/SAREC report [Sida/SAREC 2000] cited in this study.

7.1.1. Plan (UNAN-Leon)

A panel of five questions (see annex 12.14.1.) was given to eight groups composed between 12 to 15 UNAN-Leon academics. Groups discussed for 2 hours, answered the questions and resumed their findings in a 15 min oral presentation and in two-four written pages. Previous to the evaluators' visit, two different questionnaires (see annex 12.8.1. Tables 1 and 12.8.2. Table 2) were given to academics involved in the Sida/SAREC cooperation. Questions were divided in four clear-cut categories to facilitate the quantitative analysis. Questionnaires were filled anonymously, included in a closed envelope and personally collected by E. Moreno. In addition one section for general commentaries (1/2 page) was allowed. Specific qualitative questionnaires were given to the team leaders of each project (see annex 12.8.3. Table 3). Direct structured interviews with the various Nicaraguan and Swedish groups and with team leaders were attained. The same basic questions were asked, letting the individual and groups to speak freely during one to two hour interviews. These interviews were carried out in Leon and Managua, Nicaragua; Stockholm, Lund and Umeå, Sweden; and Heredia, Costa Rica. The general written comments and indications were pondered and compared with the responses and commentaries to the questions raised in the direct interviews.

The first draft of the evaluation was given for revision and criticisms to Sida/SAREC, UNAN-Leon personnel and Swedish counterparts at the different Universities and research Institutions. This evaluation was then revised and corrected according to the comments of the reviewers, when the criticisms were considered pertinent and adequate by the evaluator.

7.1.2. Acronyms used (UNAN-Leon)

UNAN, Autonomous National University of Nicaragua KI, Karolinska Institute; MINSA, Nicaraguan Ministry of Health; HEODRA, León Central Hospital; CA, Central America; LA, Latin America; SMI, Swedish Institute for Infectious Disease Control; CSUCA, Council of Central American Universities; NGO, non-governmental organization; UMFH, UNAN-Managua Faculty of Medicine; WHO, World Health Organization; IFS, International Foundation for Science; TWAS; Third World Academy of Sciences; KIRT, Karolinska Institute Research and Training Program; Central American-KIRT, Graduate Program in Biomedical Sciences between the Central American Universities and the Karolinska Institute; NeTropica, Network for Research and Training in Tropical Diseases in Central America.

7.2. Findings (UNAN-Leon)

7.2.1. UNAN-Leon Academic structure

A description of the academic structure, research facilities and projects participating in the bilateral cooperation has been the subject of a previous evaluation [Allbeck and Nieto 1994]. Briefly, the UNAN-Leon is composed of 6 Faculties: Medicine Sciences, Sciences, Law and Social Sciences, Chemical Sciences, Dentistry and Educational Sciences. Veterinary Sciences was founded in 1997 and receives partial support from Spanish universities. The government is structured according to the following hierarchy: University Council, Rector and Vicerectories, Faculty Council, Faculty Deans, Department Directors, Project Coordinators, Professors, Assistants and Students. The Vicerrectory of Research (Dr. Edmundo Torres), created in 2000, is under the supervision of the Rectory (Dr. Ernesto Medina-Sandino). This office intends to: i) concentrate and organize the bureaucratic activities related

to research, ii) produce an inventory of research projects and investigators, iii) approve research projects, iv) perform research funding and v) promote scientific activities. The Vicerrectory of Research coordinates actions through the Faculty Research Council (created in 2000), whose members assist the Vicerrectory in making decisions. The UNAN-Leon offers 27 professional and 29 graduate careers. The University possesses one major central Library and 6 small-specialized Faculty libraries and strong links with the Hospital (HEODRA) and the community of Leon, of which close to 60 % of the population between the ages of 18 and 25 are university students.

7.2.2. The Research Context within the Sida/SAREC cooperation (UNAN-LEON)

7.2.2.1. Public Health Program.

In the early eighties, from 1982 to 1984 Sida/SAREC initiated marginal support to the Department of Preventive Medicine. Later on several students initiated training in Sweden under the “sandwich-model”. After graduation of some of the students this department generated the Public Health Program supported by Sida/SAREC, subscribing 3 projects: Reproductive and Child Health led by Dr. Rodolfo Peña, Mental Health led by MD. Trinidad Caldera and Occupational and Environmental Health led by MSc. Aurora Aragón. The Swedish counterparts for the projects are Dr. Carina Källestå (Umeå University), Gunnar Kullgren (Umeå University) and Ingvar Lundberg (Karolinska Institute), respectively. Two projects (Child Health and Mental Health) collaborate at the level of graduate teaching, personnel and computer facilities. A house in downtown Leon has been assigned by UNAN-Leon to the Program. This house requires rebuilding, but eventually it may hold 2 or 3 projects under the same system. The intention is that the various projects cluster in a single Public Health and Epidemiology Program devoted to local and regional research as well as a regional graduate level (MSc and Ph.D.). Nicaraguan (75%) and Swedish (25%) professors would participate in the Epidemiology Graduate Program. MSc. title will be granted by the participating Universities, Umeå and Leon. These projects have strong links with the HEODRA and the Nicaraguan Ministry of Health (MINSa) and a strong impact with the community of Leon.

7.2.2.1.1. The Swedish perspective. The Sandwich Program has been cardinal for the success of the investigations and activities carried out during the bilateral cooperation [Hogstedt et al., 2001], since the essence of the activities has been data collection on site related to Nicaraguan problems. In addition, the visits of Swedish investigators to Nicaragua have been relevant to understand the local reality and to overcome some of the research problems. Moreover, the participation of Nicaraguan investigators with Swedish students (Umeå) and researchers linked to the KI and located in CA (Catherina Wesseling) have increased the efficiency of the collaboration. The collaboration between the KI and the Occupational health group has been fruitful as demonstrated by the number of publications, academic thesis, and presentations to national and international Congresses. In addition, the collaboration with the KI has served as a framework for initiating graduate programs in Occupational health. Finally the projects have served to link research with the community of Leon.

Although the Nicaraguan teams still require assistance and support from the Swedish counterparts for writing papers and grant proposals, with the recent and future arrival of well-trained investigators to Leon, this panorama may change towards a more independent conduct and sustainable performance (for the meaning of independence see section 4.7). In the case of Umeå University, their experience is that the collaboration has been favorable for both parties. About 10–15% of the research performed in the Epidemiology unit of Umeå University is related to Nicaraguan problems. The Umeå University perspective is that the Nicaraguan investigators have developed to be “researchers capable of quantitative and qualitative analysis of data with more scientific input”.

Insufficient academic background in some specific areas and English language deficiencies have been the major challenges that students have confronted during their training. However most of them have been resolved during training time. Another major problem detected by the KI is that the groups have not been stable in the sense that some UNAN-Leon investigators have abandoned their participation in order to find better opportunities. Although communication with Sida/SAREC has improved, delay in the disbursement of funds is a chronic problem that has affected the collaboration, reaching sometimes, critical levels. According to the Swedish counterpart this delay was not linked to delay in reporting, planning or requesting but in disbursement.

7.2.2.1.2. *The Nicaraguan perspective.* Investigators agree that the relationships with the Swedish counterpart are symmetrical and that relationships have improved compared to previous years. As expressed by one of the investigators “We have learned how to relate with each other”. The Nicaraguan investigators of this Program think that it is important that UNAN-Leon obtains accurate information on the Swedish investigators and research projects before sending students to Sweden. They expressed that routines, clear-rules and time schedules are necessary between both parties before sending candidates to Sweden. The group pointed out that the absence of an effective Nicaraguan tutor (as counterpart of the Swedish tutor) and insufficient administrative guidance have been major drawbacks during graduate training. Collaborations among various CA countries and Swedish institutions have been constructive in the development of research projects and academic training. They estimated that some training could be carried out within the Regional Graduate Programs offered in Central America (CA).

7.2.2.1.3. *Reproductive and Child Health.* This project was initiated with MSc. training of some students in 1986 under the “sandwich-model”. The main objective of this project is to create a group of researchers capable of carrying out intervention and surveillance systems in child, adolescent and women’s health within the Municipality of Leon [Nieto 1996]. The hypothesis is that the surveillance system will generate basic health data, supply information for planning, serve as a background-sampling frame for specific studies and constitute a setting for epidemiological training. Specific intervention studies are planned within the areas of infant mortality, domestic violence, suicidal behavior and education in sexually transmitted infections.

Among the various projects evaluated, this research area seems to be the most scientifically developed. Dr. Rodolfo Peña exerts an efficient leadership within this group of investigators who are in the process of consolidating as one of the most successful epidemiological research groups in CA. For the Nicaraguan context, this project has published an adequate number of articles (see annex 12.8.3. Table 3) generated 3 Ph.D., 3 MSc/Licenciates graduates and training of 2 professionals. Presently the program is supporting several Ph.D. and MSc candidates. A CD-ROM with all the relevant epidemiological information will be accessible. This project has a strong impact in the community, to the point that MINSA applies the epidemiological data and considers the suggestions generated by these investigators. This group collaborates with the Antibiotic Microbial Resistance group (Dr. Mercedes Cáceres) and with the Shigellosis project financed by *NeTropica* (<http://www.netropica.org>). In addition to the Regional Graduate Program in Public Health and Epidemiology, other two projects are envisioned by this group: i) studies on Dengue Fever, an important disease affecting Nicaraguan inhabitants and ii) establishment of a server with a centralized epidemiological data, that could be accessed from different localities from Nicaragua, Sweden and other CA countries.

Some of the graduates, who initiated studies at the Karolinska Institute (KI), changed to Umeå University, where they concluded their Ph.D. training. The initiative of changing from the KI to Umeå University came from the Nicaraguan students. However, these initiatives were supported by the Swedish tutors of both institutions. The reason for changing training base was mainly due to the

specific interest of the students in different research areas within Epidemiology. Dr. Rodolfo Peña expressed that “it is very important to make explicit to the students that they can change training environment, if considered necessary”. The group determined that the University of Umeå presents excellent opportunities for epidemiological studies related to the Nicaraguan reality. This group considers that the collaboration with Sweden is very important to consolidate the present achievements. They also conceive that their investigations and data could be used to attract other financing agencies for complementing part of their research activities and for future projects.

7.2.2.1.4. Mental Health. This program officially initiated 1987 with the support of Sida/SAREC. Two main objectives within this project have been pursued: i) the examination of psychological consequences from the hurricane Mitch, and ii) the establishment of surveillance systems covering all hospital admitted cases of suicide attempts [Nieto 1996]. These objectives are within the 10 more relevant problems established by MINSA.

This project is interesting and important for the community of Leon who struggles with high suicide rates, and with the consequences resulting from hurricane Mitch. This group has graduated one Ph.D., one Licenciante in Umeå University and one MSc. at UNAN-Leon. Presently there are 3 students enrolled at Umeå University, one in a Ph.D. and 2 in Licenciante. They have published 14 international articles. The investigators of this project are enthusiastic about their activities, but they are aware of the fact that to “find external funding in this area is very difficult”. This research project is totally dependent on Sida/SAREC funds.

This group expressed some concern regarding the coordination in the collection of epidemiological in Nicaragua. Concerning the “sandwich” program, the opinion is to make a realistic plan, since for some of them it is very difficult to move to Sweden for several months, mainly due to professional activities and personal commitments.

7.2.2.1.5. Occupational Health. Sida/SAREC approved support to this program in 1987. The main objective is to support the creation of a well-trained and well equipped national and regional center for occupational and environmental health epidemiological studies. The specific objectives are i) to investigate the relationship between pesticide exposure and skin contamination, organic and neurophysiological diseases, ii) testing of different methods for exposure to pesticides and iii) investigations in the relationship between labor market position, living conditions, gender and health (physical and mental). The expected results are to graduate 2 Ph.D. and one Licenciante at the KI. In addition there are 3 MSc from the graduate program at UNAN-Leon. They have published 15 papers in international journals, 16 presentations in national and international Congresses and Symposia, 3 academic Thesis. This is the most prolific team regarding publications (see annex 12.8.3. Table 3). This group also has strong links with HEODRA, MINSA, PLAGASALUD, CIES and then a significant impact in the community of Leon. In addition they have a few links with the industry. However they do not charge for the assays they perform. Despite these collaborations, they understand that their research project is dependent on Sida/SAREC funds.

One of the positive characteristics is that this project is performed by a multidisciplinary group of investigators working to resolve problems that have afflicted the Nicaraguan society for decades. Their methodologies are consistent with the objectives proposed and they have developed expertise in screening and testing of pesticides. This group is the only one performing pesticide testing for occupational or environmental human exposure in Nicaragua. This group has collaborations with a similar research project at the National University in Costa Rica (Catherina Wesseling) and with Panama. Collaborations with Washington, Texas and Barcelona Universities are in the present perspective. This is a relevant phenomenon in the context of opening collaborations for training and

fund raising and above all improving the quality of research. The development plans of this group have been carried out in collaboration with the Swedish counterpart.

Although some of the projects collaborate with this group in studies and graduate courses, several investigators (including some of the Swedish counterparts) consider that Occupational Health must remain at HEODRA as an independent project. They would like to reinforce the possibility for selecting additional tutors from third countries.

7.2.2.2. The Infectious Disease Program.

With the exception of Bacterial Antigens, all the projects of this Program share the same laboratory facilities and teaching duties. This Program is composed of the Infant Diarrhea project led by MSc. Margarita Paniagua, the Parasitic Infections project led by MSc. Aleyda Tellez/MSc. Rosario Palma, the Antimicrobial Resistance project led by Mercedes Cáceres Ph.D. and the Bacterial Antigens project led by Ernesto Medina Ph.D./Felipe Urbina Ph.D. The Swedish counterparts for the first 2 projects are Professors Hans Hallander and Ronal Mölby from the Swedish Institute for Infectious Disease Control (SMI) and KI, respectively; and for the last 2 projects, Profs. Carl Erick Nord and Andrej Weintraub from the KI. The laboratory facilities of this program are probably the best in Nicaragua. All investigators work in the diagnosis of infectious diseases in Leon, participate in local courses and most of them collaborate with HEODRA. Investigators of this Program participate in the Quality Assurance project promoted by the Quality Assurance Unit from SMI. The Microbiology team has recently adapted a tissue culture laboratory for isolating infectious agents. All investigators of these projects have to teach several courses at various Departments, leaving little time for research activities.

It is important to point out that seven investigators working in this program were initially enrolled in the Central American-KIRT program for training in microbiology and parasitology. From these, four who achieved to enter the second phase of the Central American-KIRT program obtained their MSc. and one her Ph.D. (M. Cáceres). Therefore, a significant proportion of the Microbiology and parasitology team received training (despite the fact that not all of them graduated) within this regional program also supported by SAREC, but which strategy and specific goals were different from the bilateral collaboration between UNAN-Leon and Sida/SAREC. For detail description of the Central American-KIRT program the reader is referred to [Nieto 1996] and to visit the *NeTropica* web site (<http://www.netropica.org>). At least two MSc. graduates of the Central American-KIRT program expressed their intentions to be enrolled in the Ph.D. “sandwich-model” supported by Sida/SAREC.

7.2.2.2.1. Swedish Perspective. According to Dr. Weintraub, “the collaboration has been fruitful, but rather slow in progress. The only time for research is actually in Sweden”. The costs of students can be very high from both the economical and personal point of view. There is the opinion that younger students can adapt better to the “sandwich” model and to Swedish conditions. Other drawbacks are due to technical/logistics problems at the University of Leon.

The professors of SMI/IMPI do not make a separation between the bilateral program (3 graduates) and the KIRT program (4 graduates). They know the Nicaraguan team quite well (16 years of collaboration) and have a realistic perspective of the group. However, despite the fact that the Nicaraguan students received similar training in parasitic and microbiological diseases, they have detected weak collaborations among them. One major problem is that Nicaraguans devote most of their time to alternative activities with little time for research. A major drawback is the absence of technical support for research. Swedish supervisors agree that most of the students are hard workers, but have major difficulties with the English language. Very often their “attitudes are difficult to interpret” within the framework of the Swedish temperament. They hope that all the experience and

training of the Microbiology Department team can be taken into consideration by HEODRA laboratory, which is in poor conditions, mainly related to the upgrading and absence of equipment and limited access to reagents. The Swedish counterparts would like to develop quality-controlled routines at UNAN-Leon and collaborate in vaccine trial projects. With respect to the Sida/SAREC collaboration, they expressed that objectives are not always clear and that contradictions between Sida and SAREC are frequently envisioned. Perspectives in Sida/SAREC are not always in tune with the way of thinking at the SMI/IMPI and KI.

7.2.2.2.2. The Nicaraguan Perspective. One major objection relates to the teaching schedule assigned. They have to lecture in several courses and collaborate in teaching with various Departments with little time for research. They complain about the fact that investigators can only justify teaching and administration time, but not research time.

This group also considers that the bilateral program is more symmetrical than in previous years but still requires adjustments. Accordingly, “they have evolved from sample collectors to executors of research activities”. They expressed the need of clear and consistent rules with respect to Sida/SAREC decisions. They would like more autonomy for selecting tutors and for budget distribution. Likewise, it seems to be a consensus that some training could be performed within the Regional Programs in CA and LA.

7.2.2.2.3. Infant Diarrhea. This research project initiated in 1983 by studying the prevalence of different etiological agents, mainly bacteria causing diarrhea in children that served as framework for the MSc. of Maragrita Paniagua within the KIRT program. The aim of this project is to determine the prevalence and incidence of bacteria, virus and parasites causing diarrhea within the Municipality of Leon. They intend to modify the infant diarrhea morbidity and mortality by interventional studies such as vaccination and education. This was one of the first projects supported by Sida/SAREC, and gave origin to other lines of research within the Microbiology Department. It is composed of 4 MSc. graduates from the KI (one from bilateral and 3 from CA Graduate Program in Biomedical Sciences/ KIRT), 2 young investigators (F. Bucardo is in Sweden, for short training in Rotavirus) and 2 technicians. One of the investigators (MSc. F. Espinoza) has four publications within the KIRT framework, requiring only one more and a thesis dissertation for Ph.D. graduation. Among the various infectious disease projects supported by Sida/SAREC, this is the strongest and the most developed. This project has been working with the community of Leon for more than 15 years with strong links with HEODRA and the Faculty of Medicine. Presently, this is one of the groups that is selling diagnostic services to various private enterprises. They are selling between \$4000 to \$5000/year, amount that they reinvest in research. One of the investigators (MSc. F. Espinoza) has obtained a 2-year grant from *NeTropica* (<http://www.netropica.org>).

This group wants to maintain the same line of research in the future, to perform control vaccination trials and to estimate the prevalence of infectious etiological agents causing diarrhea by routine and sophisticated laboratory techniques. MSc. F. Espinoza and MSc. M. Paniagua are planning to register in a Ph.D. training project within the bilateral program. Most of the diagnosis and laboratory methods employed by this project are unique in Nicaragua, being therefore very valuable to the country.

This group expresses its dissatisfaction with delays when signing research contracts with Sida/SAREC. “These delays negatively affect research performance, planning and reporting. The acquisition of materials and equipment and the actions for repairing damaged equipment are extremely slow and troublesome”. Among their plans they consider the opening of a laboratory facility within the University for attending students at a low cost. Presently 11 % of University budget goes to student affairs and a considerable part of these funds are spent in private laboratory tests. They believe that

selling services, obtaining grants and collaborating with other groups in CA have made them more independent. They are planning to expand these activities in the future.

7.2.2.2.4. Antimicrobial Resistance. Formally, this project was not initiated within the bilateral collaboration between Sida/SAREC but under the framework of the Central American-KIRT program in 1989. Mercedes Cáceres (UNAN-Leon) concluded her MSc. in this regional program under the supervision of Hans Hallander and Carl-Erik North from the KI. After concluding her MSc., Mercedes Cáceres continued her Ph.D. training supervised by Carl Erik North and Andrej Weintraub supported by the Sida/SAREC bilateral collaboration.

The main research objective of this project is to organize a multidisciplinary group for monitoring the bacterial resistance to antibiotics in the 5 major Nicaraguan hospitals. This project has agglutinated a group of 3 young investigators and 16 undergraduate students under the leadership of Mercedes Cáceres Ph.D. They have strong links with the Reproductive and Child Health project and have obtained a 2 year grant from *NeTropica*, collaborating with Costa Rica, Honduras and Panama in the characterization of *Shigella* strains (<http://www.netropica.org>). This group maintains strong links with the group of Carl Erik Nord and Andrej Weintraub at the KI. Grants and collaborations have made them more independent. They are planning to sell services to pharmaceutical companies and hospitals in testing for antimicrobial resistance, and to expand their granting activities. They consider necessary to open new opportunities for young investigators to carry out graduate training in Sweden. They would also like to explore possibilities of training in CA and LA.

7.2.2.2.5. Bacterial Antigens. This project started in 1991, with postdoctoral training of Ernesto Medina at the Department of Clinical Bacteriology of the KI under the supervision of Dr. Alf Lindberg. He worked on the isolation of bacterial antigens from 1991 to 1992. After his return the project continued working in collaboration with Dr. Andrej Weintraub and training of Xilda Larios (formerly enrolled in the first phase of the Central American-KIRT program) in monoclonal antibody production.

The main objective of this group is the characterization of enterobacterial lipopolysaccharides and polysaccharides for diagnosis and biotyping. One of the objectives is the generation of a multidisciplinary working group for research and academic activities. The laboratory facilities of this group have improved and are shared with the group working with pesticides within the Occupational Health project (Dr. José Ma. Cabezas Ph.D. from KTH, Sweden). This group has 2 Ph.D. and 2 young investigators. There is one student obtaining his Ph.D. in genetics in Germany. The 2 Ph.D. graduates have carried out postdoctoral training at the KI. In spite of Dr. Medina's duties, this project has prospered in the hands of Dr. Urbina. From the scientific point of view, this group is quite advanced. This project collaborates with Dr. Weintraub, has generated 17 publications and has organized a regional course in the characterization of lipopolysaccharides. This group considers necessary to open new opportunities for young investigators to carry out MSc. and Ph.D. training in Sweden. It seems that "the new generation of young investigators is better trained than previous students".

7.2.2.2.6. Parasitic Infections. This project started in 1982 with the study of amoebiasis which served as a framework for the collaboration between Teresa Rivera from UNAN-Leon and Drs. Hans Hallander and Ewert Linder from the SMI/IMPI. In March 1988 the project continued with serological and entomological study on *Trypanosome cruzi*, etiological agent of Chagas disease and its triatomine vectors that served as the basis for the MSc. training of Teresa Rivera. Presently, the main objective of this project is to develop methods for the diagnosis and prevalence studies of amoebiasis, giardiasis, cysticercosis and Chagas disease in the municipality of Leon. Five MSc graduates (2 from KIRT, 3 from the bilateral cooperation) and 4 Bch. participate in this project. This group has published

5 national and 6 international papers. The topics are important and relevant for Nicaragua. The participating personnel is well trained but leadership is scattered within the various subprojects. A major part of the responsibility is in the hands of a few Swedish scientists in SMI who are not necessarily devoted to these research topics on a routine basis, outside their collaboration with Nicaragua. No young investigators are enrolled in this Program. The Parasitic Infections Project is almost 100 % dependent of Sida/SAREC research funds for its activities.

This group expresses its dissatisfaction with the lack of support and the lack of equipment. One of the problems they have detected during the cooperation with Swedish institutions is the absence of clear lines and objectives. “Some works have been finished, written down but still not published”. They will appreciate “more autonomy” for selecting their counterparts since “sometimes the expertise they require is not in the laboratories where they were sent for training”. In this respect they believe that some training will be better achieved within CA or in other countries, such as Uruguay, Brazil or Mexico.

7.2.2.3. The Library (UNAN-Leon)

Support to the Library started in 1985 through a specific project (Library Support). The funds were allocated for a seven-year period (1985–1992), skipping one year (1993) and then assigning new funds as recommended [Nieto 1996]. The aims of the Library system are the development of modern and versatile *modus operandi* for the benefit of customers and to support academic and research activities. They concentrate efforts in Biomedical Sciences. Some of the specific objectives are the acquisition of textbooks and journals and the improvement of communications. The Library receives 45 journals for a total of 1300 issues in the last 3 years. They have upgraded the books, encyclopedias and dictionaries, and initiated steps towards the acquisition of electronic publications. They have moved from traditional to computerized databases. They have 65 computers (Sida/SAREC =24, Lund University = 4, CSUCA = 2, Valencia-Spain 25, UNAN-Leon = 10) distributed in one central Library and six departmental libraries, most of them with Internet access (80%). The personnel responsible include 2 Masters, 4 Bachelors and 2 assistants. About 20% of the personnel have been in international workshops related to the management and modernization of libraries. The physical facilities of the Library system have improved in comfort and in the attention to the customers. The number of customers is estimated in 250,000 per year (see annex 12.8.8. Fig. 3).

This group expressed four main concerns. The first one is related to the slowness of the purchasing orders and slowness in the arrivals of the purchased books, journals and equipment. The second one is the lack of space and personnel for attending customers. The third one is related to the number of assigned and specialized personnel. The fourth one and most problematic is the renewal of books, journals and equipment. Their estimation is that the Library requires at least 20,000 USD per year to maintain the system and renewals at background level without new acquisitions. They understand that the Library system is very sensitive and dependent on foreign aid.

7.2.3. General Quantitative Perspective (UNAN-Leon)

Some quantitative relevant data are presented in Tables 1–4 and Figures 1–6 in the corresponding annex (see annex 12.8.). UNAN-Leon has signed cooperation agreements with 49 Universities, most of them from Europe, and has received support mainly from 22 agencies. External funds constitute between 6 % to 9 % of University annual budget. From this, about 4% to 5% is dedicated to research activities, including staff training in foreign countries. Sida/SAREC bilateral cooperation is not only the largest financing agency of UNAN-Leon but the most sustainable in time.

From a total of 17 projects registered in the Area of Public Health, 14 are currently supported by Sida/SAREC and the other 3 indirectly benefit from the infrastructure and investigators supported by the bilateral program (see annex 12.8.4. Table 4). Moreover, from 10 projects carried out in the Faculty of Sciences, at least 3 indirectly benefit from the Sida/SAREC cooperation. From 18 external services offered by the University, 7 are performed by laboratories and investigators that have received support from Sida/SAREC (see annex 12.8.10. Fig. 6). The UNAN-Leon program for young scientists (a total of 12 students, average age of 25 years, range 23–30 years) was initiated with funds from the bilateral cooperation. Presently this program is entirely financed by the University, with the participation of all the young investigators in projects sponsored by Sida/SAREC.

Forty-nine academics involved in the bilateral cooperation were interviewed (55 % males and 45 % females) and expressed their opinion, both orally and in written formularies. The results of the formularies are summarized in Tables 1 (see annex 12.8.1) and 2 (see annex 12.8.2.), and only some relevant points will be stressed here. Under the bilateral cooperation (including the Graduate Program in Biomedical Sciences KIRT/CA Universities 1987–1998), 5 Ph.D., 13 MSc/Licenciate, 2 postdoctoral and 12 short training activities have been supported in 19 years. The average time of graduation for 5 Ph.D. and 13 MSc/Licenciate has been of 10 and 6 years, respectively. Currently 9 Ph.D. and 5 MSc/Licenciate students under the “sandwich” model are supported. The average age of the graduates is 42 years (range 35–49 years) and 90 % are married with more than 2 children. If graduation is achieved in 2002, the average graduation time for the Ph.D. and MSc students will be of 12 and 5 years, respectively. About 90% of the graduates considered that their training was practical and theoretically balanced. Only 25 % of the personnel participating in Sida/SAREC projects dedicate more than 50 % of their time to research activities. Although most of the participants (91%) enjoy their work at the University, a considerable proportion (42%) is obligated to work privately or to take a second job.

The number of publications per area supported by Sida/SAREC is presented in Table 4 (see annex 12.8.4.). Sixty-seven publications were in international journals and 50 in national journals or abstracts in Congress presentations for a total of 118 publications in a twenty-year period. For Nicaragua, this is a very significant and important contribution. Close to 80 % of the publications have been produced in the last decade and close to 50 % in the last 5 years. This represents a significant progress and improvement on time.. Most of the participants (90 %) considered that the service offered by the Library is adequate, although an important proportion (35 %) declared major problems in finding what they need. Fig. 3 (see annex 12.8.7.) shows that the number of Library users has steadily increased through the years, suggesting a positive impact of the support given by Sida/SAREC to the modernization of this facility. Most of the participants (94%) in the bilateral cooperation have access to computers and to Internet.

7.2.4. General Qualitative Perspective (UNAN-Leon)

The indicators of the positive development are not only measured quantitatively (most of them listed above and in the annexes) but also in qualitative terms [Nieto 1996, Sida/SAREC 2000]. The cooperation has contributed to the creation of institutional platforms dedicated to the promotion of science and to the establishment of research priorities. In addition, the cooperation has been valuable in improving routines for the management of external funds and for administrative and Library development necessary to support research activities. The modernization of laboratories, libraries, communications and institutional facilities for supporting scientific activities is also a positive outcome of the cooperation.

Another positive aspect has been the generation of upgraded academics capable of lecturing at different levels. This event has a positive impact in the quality of courses in Biomedicine and Public Health and in the creation of graduate programs. The projects supported by Sida/SAREC have also served as a framework for training students and technicians. In course, this has generated a group of motivated young investigators and trained technicians with good laboratory skills, and better academic preparation that are essential for the continuity of the projects. All the young investigators participating in projects supported by Sida/SAREC possess an adequate knowledge of the English language. In perspective, this has been also a positive experience transmitted from Nicaraguan investigators educated in Sweden, who have recognized the relevance of the English language for scientific training. The arrival to UNAN-Leon of well-trained individuals has generated leadership and favored the formation of research groups within the lines of research supported by Sida/SAREC. Most of the groups maintain links with Swedish investigators and a few of them have initiated regional projects. Leadership has also concentrated resources and agglutinated people from different areas with common interests. The creation of multidisciplinary groups, although requires more effort, it is seen as a normal process within the framework of research activities.

Several works have stressed the benefits of the “sandwich” training model [Allebeck and Nieto 1994, Hogstedt et al., 2001, Nieto 1996, Sida/SAREC 2000]. The most obvious benefit of the “sandwich” model is the generation of well-trained individuals who maintain strong links with their home country and university, reducing the chances of brain drain. Other benefits are the establishment of strong links with Swedish investigators and the generation of first class and upgraded research based upon Nicaraguan problems. The visits of Swedish counterparts to UNAN-Leon, and the close contact with Nicaraguan students have contributed to the understanding of the Nicaraguan reality and concern of the Swedish counterparts with relation to local problems. Similarly, the visits of Nicaraguans to Swedish laboratories have contributed to the understanding of the benefits of performing high quality research under more favorable circumstances.

Both, the authorities and the research groups have strong concerns regarding the future and sustainability of the projects. The University has taken a major step in supporting with its own funds young investigators who initiated activities under Sida/SAREC support. All these young investigators are 100% devoted to research and represent a very important counterpart of the activities supported by the bilateral program. During our visit to Nicaragua, the Rector signed agreements with various industries and local producers for selling services. A few research groups have undertaken the initiative of external services (see annex 12.8.10. Fig. 6), while others are applying for grant money. By these means, a reduced number of investigators have generated small funds that have allowed them some independence, which is appreciated by others, constituting a positive example.

Most of the research groups have integrated their activities with the community of Leon. The impact of some projects is clearly reflected by the importance that MINSA has given to the epidemiological data generated by UNAN-Leon investigations. Scientists trained under the bilateral program have transferred many laboratory practices and routines to the HEODRA and to other laboratories. A major part in the diagnosis of infectious diseases, detection of pesticide skin contamination and upgraded laboratory and epidemiological techniques carried out in UNAN-Leon are unique in Nicaragua, and therefore constitute a very valuable asset for the country as a whole.

Ownership of the projects is a well-developed initiative by the different UNAN-Leon investigators. With a few exceptions, most of the interviewed researchers and administrators agreed that the projects were more related to Nicaraguan than to Swedish problems. Moreover, all projects investigated in UNAN-Leon and supported by Sida/SAREC are devoted to resolve specific questions in biomedicine and public health relevant for the Nicaraguan society.

Under my own perspective, the main achievement of the bilateral cooperation has been the generation of research groups capable of producing their own ideas and establishing their priorities. In turn, this has generated enough self-confidence to rise constructive criticisms with respect to i) their own performance; ii) the University system; iii) activities and attitudes of the Swedish counterparts; and iv) the Sida/SAREC cooperation project. The fact that the Rector of UNAN-Leon is a scientist with a postdoctoral training in Sweden (KI) is an indication of the relevance that Sida/SAREC program has in this University. A great majority of authorities and academics consider research activities relevant for UNAN-Leon development. Unfortunately this principle has not reached a consensus, although important steps have been performed to achieve this goal. Even though this may sound trivial to investigators from developed Universities, this is a significant achievement in Nicaragua where research is not part of the country's tradition.

7.3. Conclusions and Recommendations (UNAN-Leon)

7.3.1. Significant Drawbacks (UNAN-Leon)

7.3.1.1. Sustainability (UNAN-Leon).

The major problem regarding research projects and achievements refers to sustainability. In spite of the efforts, the projects supported by Sida/SAREC are extremely dependent on the cooperation. I am convinced that without this cooperation all research activities, laboratories, training programs and Library facilities would dramatically deteriorate in a short time. It is also likely that under these circumstances, the qualified personnel would move from the University in order to find better alternatives.

Although most of the MSc and Ph.D. graduates and the personnel from the Vicerrectory of Research are well trained and enthusiastic with respect to scientific activities, most of them are not acquainted in writing grant proposals and fund raising. There is not a dynamic attitude towards fund raising. This is clearly evidenced by the very few research applications for competitive or restricted funds to international agencies. A strong desire from University authorities and research groups in diversifying their research funds were detected. However these activities were not coordinated but rather isolated (e.g. *NeTropica* applications).

7.3.1.2. Management of Research Funds (UNAN-Leon).

Although routines for the management of research funds have improved, changes are still required to make these routines more efficient concerning research activities. Investigators complain about the slowness of the bureaucratic routines necessary for the disbursement of funds and for purchasing equipment, reagents and other items.

7.3.1.3. The Research Groups (UNAN-Leon).

The susceptibility of most research projects and academic activities is aggravated by the lack of repetition in training fields among the different investigators. That is, retirement of one investigator from the University may mean that the project would also be abandoned, due to the fact that no other person is trained to take over the project. Very likely, teaching at undergraduate and graduate levels will also suffer from this absence. Leadership, mainly carried by well-trained personnel is even more susceptible, since in spite of their commitment, individuals are frequently tempted to perform other jobs.

7.3.1.4. The “Sandwich” Model (UNAN-Leon).

Two “sandwich” models have been functioning at the various projects financed by Sida/SAREC: the open and the close “sandwich” models. In the first model the student has a tutor in Sweden but he/she does not have a tutor in their home country; in the second model the student is under the responsibility of two tutors, one in his/her home country and one in Sweden. The virtues of the closed “sandwich”

model have been described elsewhere [Allebeck and Nieto 1996; Hogstedt et al., 2001; Nieto 1996; Sida/SAREC 200], and will not be discussed here.

Due to the reduced number of qualified scientists in Nicaragua whom could function as counterparts, most of the students of the bilateral program have participated in an open “sandwich” model. This model has several disadvantages. Without the support of a strong local counterpart, i) students are frequently committed (or voluntarily involved) to many academic and administrative duties with little time for research; ii) local research activities are seldom accomplished; iii) frequent contacts with the Swedish counterpart are weak; iv) due to the absence of control of the duties, trips to Sweden are delayed and planning is not effectively achieved; v) the control of the experimental data and collection of samples becomes less efficient; vi) the control and theoretical execution of the research project is mainly under the responsibility of the Swedish tutor, putting a lot of constraints on the Swedish counterpart; vii) consequently, these Ph.D. projects may take between 8 to 15 years (average 12 years) to be concluded. Various Ph.D. candidates are confronting severe personal problems or have acquired professional commitments that make traveling very difficult. Under these circumstances, graduation for several of the candidates is an extremely difficult challenge. Slow actions in Ph.D. graduation may delay opportunities for well-trained young scientist working at UNAN-Leon within the framework of the bilateral project.

Both, long lasting Ph.D. students and Swedish tutors are prone to develop a stage of “extreme tolerance” and dependence. In many cases this comes to a stage of equilibrium in which no clear decisions are taken. On the one hand tutors have the tendency to accept this circumstances, despite the fact that it is not commonly accepted within the framework of a graduate training in Sweden. On the other hand, dependence on the Swedish counterpart hampers the initiative of the student to make changes regarding his/her Ph.D. training. A final consequence of the long lasting graduation is that experimental data may become obsolete and then difficult to publish and to include in the framework of a thesis.

7.3.1.5. *The Library (UNAN-Leon).*

Library improvements on the lines that were suggested [Allebeck and Nieto. 1994] favored the increase in the number of customers for this division (see annex 12.8.7. Fig. 3). At this point, many of the Library facilities are saturated, including the employees who hardly have time to attend the demands of the customers. Part of the problem is due to the reduced number of computers and the absence of a server that could centralize all the information. Although the Library is using cybernetic systems, they are not taking full advantage of the on line and CD-ROM information facilities. Dependence on hard copies, mainly books and journals, instead of CD-ROM or internet publications considerably increases the transportation costs and complicates the importation due to the heavy weight and bureaucratic management at the customs office. Moreover, most journals arrive with a delay of 6 to 12 months. These purchases are a waste, since several of the biomedical journals acquired by the UNAN-Leon Library are already released freely after 6 months or one year of publication by the publishing companies (e.g. ASM, JBC, PNS publications). Limitations in the “Colima” software used for searching publications were detected (e.g. no registration in the number of customers or entries are registered). This hampers the collection of data and increases the work of employees who are forced to gather information by hand. Although employees are well trained on the basic Library functions and in computer programming, the lack of knowledge in obtaining accessible cybernetic information through the Internet and CD-ROMs is working against Library efficiency. The reduced number of volumes, upgraded books and journals is a chronic problem that has been pointed out previously [Allebeck and Nieto 1994]. Internet access is too slow, making it useless for several applications. The major problem is the repairing and upgrading of the computer system, which must be replaced at least every 5 years. In this regard the Library system is also very sensitive.

7.3.1.6. Collaborations (UNAN-Leon).

Besides the collaborations with Swedish groups, little cooperation with local, regional or international investigators has been accomplished by the UNAN-Leon researchers. Very limited information regarding funding agencies and training is available for the UNAN-Leon investigators.

Through out the study I detected very little joint publications among UNAN-Leon investigators and no common publications between local groups. Similarly, with one single exception (M. Cáceres and R. Peña groups), joint proposals between investigators from different groups were not detected (<http://www.netropica.org>). Although some groups overlap on training, general objectives and disciplines, they seem reluctant to joint efforts in a single enterprise. This is clearly seen in the Master project in Epidemiology organized by the Department of preventive Medicine and Public Health with Umeå University and the Master project organized by the Occupational Health in collaboration with Costa Rica and the Karolinska Institute. Both groups are initiating separated academic enterprises despite the fact that basic epidemiological methodology, statistical techniques, academic training and population are common to both projects. A similar disjunctive has been detected in other disciplines; mainly in infectious diseases research projects. This disjunctive is not intrinsically problematic by itself. However, taking into account the reduced number of trained academics in Leon with MSc. and Ph.D. degrees in these areas, these separated activities dilute efforts.

7.3.1.7. English Language and Academic Proficiency (UNAN-Leon).

More than half (56%) of the students who were trained abroad recognized having problems in the usage of the English language during their studies. With no exception, all the Swedish tutors recognized that most of the Nicaraguan students had major problems in the usage of English, and pinpointed difficulties in written and oral communication as the major handicaps that students presented during their training.

A considerable number of Swedish tutors alleged that students had insufficient academic level in some specific areas necessary to initiate research in Sweden and that most if not all of these deficiencies would be easier resolved in Nicaragua, before commence her/his training in Sweden.

7.3.1.8. Symmetry (UNAN-Leon).

Most of the investigators perceived that during the first 10–15 years of the bilateral cooperation, the decisions were not symmetrical. That is, most of the decisions were taken in Sweden and not in Nicaragua. Although several investigators believe that this asymmetrical relationship has equilibrated in the last 5 years, about 1/3 of them still believe that the Swedish counterpart mainly takes a major part of the decisions, including the distribution of funds and budget planning.

7.3.1.9. Information of Sida/SAREC Policies (UNAN-Leon).

Several of the UNAN-Leon investigators and authorities expressed that Sida/SAREC policies have not been always clear and consistent. Information is not equally distributed among the different academic strata and contradictory information has been received at different levels during this time. One of the major drawbacks indicated was related to the changes of the personnel assigned to the bilateral cooperation by Sida/SAREC in the eighties and early nineties. This caused misunderstandings and confusion in some of the activities.

7.3.1.10. Justification of Research Activities.

UNAN-Leon regulates teaching and administrative activities, but not research activities. From this perspective research does not exist as a formal coordinated activity but as an unofficial one. The fact that academics can only justify teaching and administration time, but not research time works against the efforts for the consolidation of a research system. As expressed by one of the investigators:

“unfortunately, some groups within UNAN-Leon still consider research as a hobby and not as a relevant university activity”.

7.3.1.11. *Absence of Expertise (UNAN-LEON).*

There are research topics related to tropical diseases that are relevant in Nicaragua but not in Sweden. In some cases it is difficult to find a Swedish counterpart specialized in certain tropical pathogens. One example is Dengue Fever, which is endemic in Nicaragua, also causing epidemics. “It has been difficult to find a specialized investigator in Sweden dedicated to study this virus”. In this respect relevant topics remain in a “limbo” within the UNAN-Leon priorities without support and training.

7.3.1.12. *Laboratory Equipment (UNAN-Leon).*

Some of the necessary equipment for research has deteriorated while other is obsolete. Responsibilities for taking care and sharing of the equipment need to be improved. According to several investigators, repairing of equipment is very difficult to achieve, mainly sophisticated digital items. Service given by the companies is slow, expensive and not very efficient, due to the fact that most representatives are not in Nicaragua. Researchers require more assistance from the UNAN-Leon administration to take care of laboratory equipment.

7.4. Recommendations (UNAN-Leon)

In my own perspective, sustainability of what has been achieved is the first challenge that must be confronted. The second difficulty is related to the efficiency of the bilateral collaboration. I will concentrate my recommendations in these two aspects.

I am convinced of the convenience of maintaining the Sida/SAREC support in order to consolidate the efforts carried out for already 20 years of collaboration. With the support of the bilateral cooperation, research projects, undergraduate and graduate activities very likely would evolve to a more advanced stage, necessary to approach sustainability. It is recommended that at least for a period of ten years, the economical support should be maintained or even increased, mainly in those projects in which cooperation among different groups is attained (e.g. links between Epidemiology and Occupational Health or with the diagnosis of Infectious Diseases projects). Taking into consideration that no more than 1 % of the total Swedish assistance to Nicaragua is devoted to UNAN-Leon, I have to say that the achievements reached by this University in building research capacity in Biomedical sciences has been substantial and reasonable effective. Moreover, due to the fact that the activities of UNAN-Leon are strongly linked to the community of Leon, it is clear that the development and research activities of this University have strong social influence. This efficiency also calls for attention to the significant imputes in economical terms and human power that UNAN-Leon has devoted during the bilateral collaboration.

The Vicerrectory of Research should be reinforced and invested with more power in order to consolidate the efforts of this administrative unit. The experiences achieved by other Latin American Universities in the last 30 years indicates that strong University Vicerrectories are more efficient in promoting scientific and academic activities than national councils for research [7].

Training of the leaders participating in the Vicerrectory of Research in fund raising, higher education and in the management of funds is mandatory. In addition, Sida/SAREC could contribute to this office with dawn funds for grants, training and traveling for scientific purposes. More aggressive future institutional plans for research sustainability are necessary.

Coordinated activities for future plans in fund-raising are necessary among the different research groups and individuals. UNAN-Leon groups and the Swedish counterpart might initiate joint ventures in fund-raising with other agencies beside Sida/SAREC (e.g. European community). In this respect, the

Swedish research groups could be very valuable in introducing the research projects of Nicaragua within the framework of collaborations with other European countries through joint proposals.

Sida/SAREC in collaboration with UNAN-Leon authorities and Swedish counterparts could contribute in the development of a University Research Council that could establish research priorities, and objectives and above all, make institutional plans and take decisions based on quality and proficiency of the research groups.

Preparation and assistance in the art of fund raising and in the identification of international funding agencies and relevant non-governmental organizations (ONGs) is mandatory. Training has to be carried out at four different levels: institutional (e.g. Vicerrectory of Research), Faculties and Schools, research groups and qualified investigators. Local and Regional courses in fund raising are recommended. Fellowships for investigators to learn in third countries the art of fund raising (e. g. from successful researchers) would be a major contribution towards sustainability. Examples of very successful research groups in fund raising are found in LA countries such Mexico, Brazil, Costa Rica, Uruguay and Chile. For Nicaraguan researchers the LA groups may represent a better alternative since the topics, circumstances, comparative advantages and drawbacks are similar. However, this does not exclude learning in other countries, including Sweden.

Establishment of strategical alliances with institutions, laboratories and individuals for increasing the quality and funding opportunities of projects is necessary. Sida/SAREC collaboration may be presented as counterpart for alliances with relevant contacts. Stimulation of joint research projects with first class laboratories, with non-governmental organizations and with members of the productive system is essential for long-term sustainability of research activities. Sida/SAREC could encourage these alliances by supporting tripartite collaborations between Swedish institutions, Nicaraguan laboratories and a third country (e. g from the region or from LA). Sida/SAREC could bring together different programs supported by Sweden in other countries. For instance, it would be of great interest to support projects between Nicaragua and Honduras with the participation of a Swedish institution: These three laboratories could make alliances with other European laboratories and submit applications to the European Community (e.g. RTD actions). Sida/SAREC could proportionate to the Vicerrectory of research some small funds for bringing the different groups together for planning.

Within this framework, it is mandatory that the research groups of UNAN-Leon identify their comparative advantages with respect to other countries, and establish priorities based on these advantages. For example, the excellent health surveillance and epidemiological data generated by the different research groups on the community of Leon could be presented to third parties to explore collaborations. A turn on of the unfortunate circumstances may convert these conditions in comparative advantages. For this it is necessary that research groups systematize the information making interesting and valuable this information for international groups and enterprises to participate. Comparative advantages are found everywhere, but they require interdisciplinary research in order to detect and present them as coherent enterprises. Accordingly, the Vicerrectory of Research of UNAN-Leon in collaboration with Sida/SAREC could play a catalytic role on the groups for the identification of comparative advantages for establishing beneficial and successful collaborations. Many constructive examples for deriving benefits of comparative advantages are found in LA countries [Mata 2000; Teixeira and Benchimol 1993; UFRGS 2000; www.ufrgs.br].

Projects capable of generating funds through economical activities related to research, such as diagnosis, detection of pesticide contamination, relevant epidemiological and demographical information, consultancy and the creation of a small laboratory for attending students and personnel should be supported. Small enterprises at the Library, such as selling photocopies, books, paper etc., should be encouraged. The logic behind these activities is reinvesting the earnings in the projects.

From my viewpoint, among several investigators at UNA-Leon still remains the perspective that research and academic activities are not compatible with academic/research-based economical enterprises. This is a purist view that should be eradicated, since it hampers the advancement of science, education and the integration of research activities with society and with productive sectors. All successful Universities in the world have strong links with industry and sell services without detriment of research or academic activities [IVA/VINNOVA 2002]. This does not mean that everybody at UNA-Leon has to be involved in selling services. At the same that these activities are encouraged, they should also be carefully planned and controlled by the University. These activities should not depart from University main objectives and priorities. Examples of successful enterprises are seen in the Infant Diarrhea project and other research projects at UNAN-Leon (see annex 12.8.10. Fig. 6) and activities carried out by several CA Universities [Fundación UNA 2000; UFRGS 2000].

Assistance in the simplification of routines for disbursement of funds, purchasing of equipment and materials is required. Routines must improve as indicated by the financial audit [KPMG 1999]. Training of personnel in some of the LA institutions (e.g. Foundations) for the management of research funds, purchasing and dealing with customs is recommended.

It is mandatory the reporting and planning of the projects and submission of proposals to Sida/SAREC is achieved on time. In some cases it was detected that reports and proposals lacked detail and sufficient financial and scientific information. In several cases is difficult to evaluate the achievements during time, since practically the same information is included from year to year. More discipline in reporting and planning is necessary within strict deadlines. If these deadlines cannot be attained on time, cross-talk between the projects and Sida/SAREC is mandatory in order to adjust the schedules. Disbursement of funds should be attained on time in conjunction with reporting.

Although groups have achieved a certain level of maturity, they still require trained personnel and more research before becoming independent scientific teams. It means that research groups and investigators should be able to diversify their research fund sources (e.g. in different countries and from their own enterprises). This also implies that they should be able to submit grants and publish papers as corresponding authors and train MSc. and Ph.Ds in their own graduate and regional programs to a larger extent that is currently being performed. Independence in research capabilities does not mean strict economical independence, since most researchers in the world depend upon external funds. Independence in this sense means development of their own capabilities for performing research, even in the absence of Sida/SAREC, not because this source is irrelevant, but because other sources will bring stability to the research activities. Independence is not synonymous of sustainability, however, independent research groups are necessary to achieve long-standing research sustainability and development. Moreover, independence reinforces collaboration, and in this sense may bring Swedish and Nicaraguan scientists together in fruitful research ventures.

For all these reasons, I suggest that Sida/SAREC concentrates on the same projects it has supported in the last years. The actual level of funds devoted to UNAN-Leon does not allow dispersion of these funds in collateral or additional projects. Although the efficiency of the research projects is still far from being optimal and not homogeneous among the groups, the truth is that they have obtained a very significant relative advancement that should not be interrupted or diminished. If new projects are going to be financed, they should be supported with additional funds. This does not imply that the assigned funds to the current projects should not be negotiated on the basis to quantitative and qualitative parameters.

Efforts should be made in consolidating groups through education of young scientists (see below) as well as in the contribution of small grants as suggested [Allebeck and Nieto. 1994]. For consolidation of

research groups and graduate programs it is necessary to accomplish certain level of repetition in training fields for individuals. It is important to educate investigators in the same fields as previous graduates. Support of graduate training for young investigators working in the projects financed by Sida/SAREC, is recommended. A ten-year plan for education in specific areas (e.g. those already supported by Sida/SAREC) must be developed by the Universities and presented to Sida/SAREC. This plan must include deadlines and if possible names and position of the first young candidates in a waiting list and names of the possible institutes and tutors for these candidates.

Strategies for the selection of tutors and working places made on the basis of visits, experience, specific interest and commitment should be developed by UNAN-Leon. Joint planning based on reality is mandatory. Both parties should consider differences in graduate requirements. Changing tutor or rejection of a graduate student should be estimated as a real and practical solution, rather than a traumatic action. Relationships between students and tutors should be understood as academic experiences rather than as conditional interactions. Identification of Swedish counterparts committed with the bilateral cooperation and demonstrating significant comparative advantages for the Nicaraguan counterpart is mandatory for achieving efficiency in the collaboration.

Routines for the selection of students based on English language proficiency, academic background, age, commitment, real possibilities, should be established. The different Faculties, Departments and University authorities should pursue clear standards for the selection of students to be enrolled in the bilateral collaboration. Expectations should be clearly expressed to Sida/SAREC and to the Swedish counterparts.

It is my perspective that the (open) “sandwich” model has reached a critical point and changes are required. I consider mandatory that both, the Swedish and the Nicaraguan counterparts re-evaluate and discuss their activities and possibilities, based in reality and chances of success. As pointed out above, graduation for several of the candidates is becoming extremely difficult, and chances of success are very low for some of them. Furthermore, considering that some of these senior graduate students are already consolidated academics at UNAN-Leon, who are working in or leading research groups, their absence may cause more problems than benefits to the system. Both parties must consider retiring some of the senior students enrolled in graduate training in Sweden and give chance to a new generation who has been trained under the research groups supported by Sida/SAREC. In this respect the first generation of investigators under the bilateral and KIRT programs understood well the need of possessing good basic academic training and adequate knowledge in English language and have trained a group of young investigators in this direction. The existence of research groups and trained investigators in Nicaragua that could now serve as counterparts favors the development of a closed “sandwich” model, possessing clear advantages as discussed previously.

In addition to the sandwich model, diversification and finding other alternatives is necessary. For some students the sandwich model may be particularly difficult (e. g. single women with children). For some students with interest in tropical diseases, the sandwich model may not represent a particular advantage if there is not a qualified tutor in Sweden, unless is combined with a third country (triangulation) possessing the indicated experience. Support for graduate training in CA or in other LA countries is recommended, mainly when expertise can not be identified in Sweden. Training in a third country may increase the chances of graduation and reduce the expenses (compared to Sweden). For this would be important that both the UNAN-Leon and Sida/SAREC make a careful evaluation of the alternatives.

There is no doubt that deficient academic background and deficient knowledge of English language work against efficient training. Besides satisfactory academic knowledge, student candidates must demonstrate an adequate knowledge of the English language (written and conversational) before being

accepted as graduate students in Sweden. International exams such as TOEFEL, Michigan and British Council evaluations could serve as parameters. Candidates who do not demonstrate the adequate knowledge in English must not be accepted in the program.

Prior to initiate studies in Sweden (from six months to one year), candidates must request information to the Swedish institute on the basic academic requirements. If necessary students shall take specific academic courses in Nicaragua or in the CA region to level up their academic background to the standards required by the Swedish institute. The Swedish counterpart should actively participate in this process, suggesting those courses necessary prior to the initiation of studies in Sweden. This could be done by consorted bilateral agreements.

Institutional plans (e. g. fellowships for attending conferences, visiting laboratories etc.) for promoting local and international collaborations must be undertaken. Funds for coordinating this kind of activities could be managed in the Vicerrectory of Research. Graduate training within CA or LA would increase the contacts between researchers in the region.

The Vicerrectory of Research in coordination with the Faculties, Schools and research groups should be aware and distribute information regarding international fellowships, grant opportunities, training courses and academic activities performed abroad. Training in this area is required. Swedish Universities and research institutes are especially efficient in promoting these enterprises. In this sense Sida/SAREC could also contribute by facilitating information regarding other programs supported by Sweden and if possible to facilitate the links between activities performed in different countries.

Although employees are well educated on basic Library functions, they require training in modern strategies for obtaining information through the Internet and CD-ROMs. They require specialized personnel in the area of biomedical sciences and biomedical searching. It is recommended to train at least one person in performing searches on biomedical research periodicals. Journal hard copies must be substituted by CD-ROM versions. Optimization of the system will allow more subscriptions for less money. The Internet facilities must be adjusted in order to achieve speed. It is necessary to develop a centralized Library computer system. Upgrading Library computers is also relevant and necessary for supporting research projects.

The perception of a number of investigators “that relationships between both parties have not been symmetrical” and “that information has not been always clear-cut”, deserves attention. Valid or not, it is important to take these opinions into consideration and to clarify the motives and the direction of the Sida/SAREC cooperation in the future. It is important that all information is distributed at the various academic strata.

UNAN-Leon should concede that time devoted to research is a legitimate academic activity that requires official recognition by the university administration. Although this has been a constant concern of University authorities, the reality is that UNA-Leon has not reached the necessary harmony among the different Faculties and Schools to negotiate and recognize research activities as official enterprises performed at the University. This is a very important handicap in the development of science in a public University.

Experiences in other LA countries have demonstrated that official recognition of research activities at the same level of teaching, administration and extension increases all activities improving the quality of the University at various levels. This recognition should be reflected in concise and specific credits and privileges (working hours, academic status, postdoctoral training, sabbaticals, salaries etc.) and be part of a concerted system between the research groups, the Faculties, Schools and the Vicerrectory of Research. Recognition of research activities would allow the creation of Research Centers and

Institutes that would bring together scientists. It is advisable, in this process to incorporate the Schools and the Faculties, in order to maintain the links between quality of teaching and research activities. Sida/SAREC could facilitate this process by promoting training of University Academic authorities (e. g. Deans, Directors and Coordinators) in higher educational programs.

It is also relevant to establish priorities when purchasing equipment. Equipment purchase has to be done first on the requirements of the various groups, second on research teams needs and third on individual exigencies. Cooperation and agreements with technical institutions (e.g. UNI) for repairing laboratory equipment is suggested as a practical solution. At least one qualified specialized electrical engineer must be responsible for laboratory equipment on a routine basis. The culture of preventive maintenance of equipment has to be incorporated.

An inventory of the equipment at UNAN-Leon purchased through the Sida/SAREC cooperation agreement should be made. This catalogue should include the specifications of the equipment and the actual functioning status. Based on this, a careful plan for repairing, maintenance and renewal of equipment should be developed. The different research groups, Faculties and the Vicerrectory of research may coordinate this.

7.5. Lessons Learned (UNAN-Leon)

7.5.1. General Lessons (UNAN-Leon)

The overall picture of the Sida/SAREC assistance to UNAN-Leon is portrayed by a combined set of findings. Depending on the parameters used to judge these findings, then different conclusions could be drawn. For instance, if we judge the scientific achievements of UNA-Leon in pure quantitative and qualitative high ranking parameters used to evaluate academic and scientific performances in the so called developed countries, then we have to say that the efficiency of Swedish assistance to UNA-Leon has been low. Although, at first glance this may be a valid alternative, I strongly believe that this is not the correct perspective to judge the Swedish assistance. From my viewpoint, the bilateral program carried out by Sida/SAREC in UNA-Leon has to be judged on its significance and efficiency to educate people capable of understanding that science and scientific thinking are essential activities for development. Critical thinking within constructive parameters of specific activities (e. g. research devoted to improve education and health in Leon) are also essential for the advancement of science and for its insertion into society. Under this perspective and at the present level of assistance, although it is not trivial to count the number of papers and graduates, it is much more valuable to determine if this way of thinking has been implanted in the minds of the Nicaraguans. At the same time, and as consequence of this dialectic process, it is also important to evaluate if understanding and solidarity on the particular circumstances of UNA-Leon have been implanted in the minds and spirit of the Swedish counterparts. Considering these two aspects I consider that the Sida/SAREC assistance to UNAN-Leon in collaboration with Swedish academic institutions has been very successful, however, not concluded.

I am convinced that UNAN-Leon has reached a more mature position with respect to previous years, and now is capable of perceiving with more clarity the relevance of research enterprises in the context of academic activities. Research and science are part of the common discourse carried out by UNAN-Leon in most if not all of the activities of this Institution. At the same time, Swedish counterparts have acquired experience in the collaboration with Nicaragua, and benefited from the diversity. Although both parties could feel content of these achievements, this enterprise is far from being terminated. This is a slow process.

The impact that the positive outcomes may have for the future would greatly depend on how both parties adapt to the current situation and the strategies to resolve individual and common problems. At this point, the cooperation is in a new phase and requires adjustments and a few substantial changes. Many of the necessary changes for achieving higher efficiency in the bilateral cooperation do not require additional funds but strategically qualitative modifications and dialogue. I envision that higher efficiency could be achieved within the following 5 years. Sustainability is a slow condition that depends on many factors, among them efficiency, critical mass, alliances, aspirations and opportunities.

7.5.2. Specific Lessons (UNAN-Leon)

The advancement of science in UNAN-Leon does not depend exclusively of the scientist, but also on the context where research is being developed. In this sense both UNAN-Leon and Sida/SAREC clearly understand that improvements of the Library, implementation of routines in the management of funds and development of research administration are important factors for research to flourish. These activities must continue and expected to improve with time. In addition other practices, mainly those related to fund raising, granting, information are scarce and require an additional effort.

The Vicerectories of Research in CA universities have successfully promoted science. The fact that UNAN-Leon decided to encourage research through an office linked to the Rectory, demonstrates that science is a relevant activity for the University. In this respect, Sida/SAREC has played a positive influential role, which should be maintained. The next step is that UNAN-Leon recognizes research as an official enterprise. It is important that this recognition would not be delayed, and approved in the short term. The multiple examples from other countries similar to Nicaragua that have successfully taken these steps several decades ago, should persuade University authorities, academics and administrators that these are essential measures for the advancement of science and academic activities at UNA-Leon.

Standards for evaluating research and academic activities are indispensable activities for the qualitative improvement of research and selection of students. Although the different researchers at UNA-Leon accept that constant evaluation and criticism are current and normal procedures in science, these practices need to be performed on a routine basis at the various levels: from research groups to students. Both internal and external evaluations are required at different academic levels. International standards need to be incorporated (step by step) on a routine basis.

Collaboration among scientists and groups with similar interest and academic training must prevail in UNA-Leon where the number of trained individuals and the material resources for research are scarce. Although some groups have learned to joint forces, other groups and investigators are reluctant to be involved in common enterprises with their colleagues. Strategic alliances within the UNAN-Leon context are as important as those achieved abroad.

Despite the advantages, it is necessary to understand the limitations of the (open) “sandwich” model in the long run (mainly, the tendency to accumulate “senior” students in a “waiting list” causing low benefits for all parties). In this respect other models such as the closed “sandwich” model, triangulation between three parties (e.g. Nicaragua/Costa Rica/Sweden) or classical alternatives (e.g. 3 years in Sweden) must be balanced and considered in an idiosyncratic manner, depending on the circumstances.

Although tolerance is mandatory and beneficial, clear-cut rules and deadlines must be established in both, research activities and graduate studies. Otherwise, efficiency (time, good will and funds) and significant alternatives might be lost (e.g. fellowships for younger well-trained students already incorporated within the framework of scientific projects in their home country).

Some of the decisions and priorities established by Sida/SAREC have been modified in time. This is understandable and even may be advantageous. However, it must be taken into consideration that many at UNAN-Leon (E. Medina, M. Paniagua, R. Peña etc) and at Swedish institutions (e.g. scientists at KI) have remained constant during all these years. They may perceive some of the Sida/SAREC “new” decisions as contradictions, in the light of previous agreements. Frequent dialogue and joint planning is required. To maintain the same official responsible for the Sida/SAREC bilateral collaboration with Nicaragua has brought several advantages in the functioning and implementation of programs and projects as well as in the understanding of both counterparts.

I understand the myriad of urgent needs that the Nicaraguan universities have. Despite this, I consider very positive and rewarding the initiative of Sida/SAREC to concentrate the cooperation in a few well-chosen projects at UNAN-Leon. I have learned that identification of individuals, groups and research topics should precede other activities (e.g. such as purchasing equipment).

I have estimated that UNAN-Leon research activities are very sensitive and a lack of support from Sida/SAREC would be detrimental from different perspectives. The acquisition of international funds should be one of the main goals of the projects supported by Sida/SAREC. Investigators should use the comparative scientific advantages of their country (e.g. research in parasitic and microbial infections, epidemiological surveillance, vaccination programs etc.), establish efficient alliances and apply for grant money. A few UNAN-Leon investigators have already realized this and have taken steps in diversifying their collaborations and expanding their funding resources. In this respect Sida/SAREC could play an important catalytic role in promoting this diversification (e.g. favoring regional agreements) and encouraging fund raising at different levels (e.g. European Community, WHO, IFS, TWAS etc.).

The lack for dedication to research has several origins and not a single one. In some instances little time for research originates from administration duties (e. g. Director of a Department, Dean, Rector etc.); in other cases it results from overloaded teaching duties (e.g. participation in several courses) and in a few cases from both (e.g. a Department Director with several teaching duties). In some other instances, the little time for research comes from the needs to perform additional jobs, or a combination of all factors, as it can be easily extracted from the results obtained in the questionnaires (see annex 12.8.2. Table 2) or from the direct interviews performed during the study. Linked to this lack of time for research is also the psychological motivation, which is not always in tune with research activities. Research requires not only time but also partnership and economical support. It is extremely hard for any scientist to be isolated and in addition to live only on scientific merits related to the degrees, papers and curriculum vitae. Incentives are necessary, not only economical but psychological and emotional. This is one of the main reasons why sabbaticals, symposia, grants and small enterprises, such as selling diagnostic services based on research ventures should be supported because they bring pride in addition to economical support to the projects. Moreover, under the perspective of many governmental and social groups, these enterprises are seen as healthy activities because they also have a positive impact to the community (e. g. offering efficient services, proportioning additional jobs, self support etc.). Indeed, these enterprises, if properly administrated by the University, could also serve to support the salaries of some of the researchers and technicians, as has been the case in many LA Universities confronted with the same problem. For all these reasons, it is necessary that UNA-Leon further develops and supports economical ventures based in research activities.

UNAN-Leon experiences should serve as a framework for the cooperation with UMFH, and at the same time UNAN-Leon can contribute to the development of UMFH. Local interactions are the first steps toward regional and international cooperation activities.

8. UNAN-Managua evaluation report

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8.1. Methodology (UNAN- Managua)

8.1.1. Plan (UNAN-Managua)

Direct structured interviews with the various Nicaraguan and Swedish groups and with team leaders were attained. The same basic questions were asked, allowing the individual and groups to speak freely during one to two hour interviews. These interviews were carried out in Managua, Lund and Umeå. The general written comments and indications were pondered and compared with the responses and commentaries to the questions raised in the direct interviews. A panel of five questions (see annex 12.14) was given to 5 groups composed between 5 to 10 UNAN-Managua academics. Groups discussed for 2 hours, answered the questions and resumed their findings in a 15 min oral presentation and in two-four written pages. Two different questionnaires

(see annex 12.13.) were given to academics involved in the Sida/SAREC cooperation. Questions were divided in four clear-cut categories to facilitate the quantitative analysis. Questionnaires were filled anonymously, included in a closed envelope and personally collected by the evaluators. In addition one section for general commentaries (1/2 page) was allowed. Specific qualitative questionnaires were given to the team leaders of each group (see annex 12.13.).

8.1.2. Scope and Limitations of this Study (UNAN- Managua)

The cooperation between the UNAN-Managua and Sida/SAREC is a recent joint venture (started in 1997). Although a few published material

[UNAN-Managua 2001] and direct interviews have served as indicator during this study it is too early to draw definitive conclusions regarding the cooperation. Therefore our understanding and recommendations should be estimated under this perspective.

This evaluation concentrates mainly in the research projects activities, efficiency of training efficacy of the collaboration between the Swedish and the Nicaraguan counterparts and in the viability and sustainability of the projects performed within the academic context of UNAN-Managua, as stated in the Terms of Reference. More detailed and general perspectives regarding the complexities of the Nicaraguan public University System are found in the general evaluation where this study inserts (see section 1 to 6).

8.1.3. Acronyms Used (UNAN- Managua)

UNAN, Autonomous National University of Nicaragua; KI, Karolinska Institute; LA, Latin America; NGO, non-governmental organization; UMFH, UNAN-Managua Faculty of Medicine; WHO, World Health Organization CIGEO Geoscientific research center CIRA aquatic research center.

8.2. Findings (UNAN-Managua)

8.2.1. UNAN-Managua Academic Structure

The National Autonomous University of Nicaragua was divided into two independent universities, the UNAN-Managua and the UNAN-Leon, in 1982. UNAN—Managua is by far the largest university in Nicaragua with 48 undergraduate programs (Bachelors and Licenciature), 19,000 registered students,

and 900 teachers employed on a full-time basis. The UNAN-Managua is divided into four faculties: Education and Humanities, Economy, Medicine and Sciences. Besides the campus in Managua, four regional centers have been established in Matagalpa, Estelí, Carazo and Chontales. Traditionally the focus has been on education and training at undergraduate level, though in recent years efforts have been made to develop graduate study programs at level of Masters. In 2001, two new Master degree programs initiated in water sciences (financially support by the Canadian Agency for Development) and in mitigation of natural disasters (with the support from COSUDE). Six research Centers, independent from the Faculties and Departments have been established as part of a strategy to develop research and the research capacity within the UNAN-Managua. The collaboration between Sida/SAREC and UNAN-Managua initiated in 1997, making this program the most recent bilateral cooperation project with this Swedish institution.

The projects supported by Sida/SAREC are inserted within the Geoscientific Research Center (CIGEO), the Aquatic Research Center (CIRA), and the Faculty of Medicine. The first students from CIGEO and CIRA began their training at in 1999. CIRA will send a second student to Sweden in autumn 2001. The Faculty of Medicine is planning to begin with two students in 2001. Swedish counterparts are, the Department of Geotechnology, Biotechnology, and Ecology at Lund University. As this program involve three parties, a brief presentation of each is enclosed (See chapter 1.2.2.).

Thomas Alveteg evaluated CIRA and CIGEO, and other research groups from UNAN-Managua and conclusions and recommendations in this areas will be subjected to his analysis.

8.2.2. Faculty of Medicine (UMFM)

The UNAN-Managua Faculty of Medicine (UMFM) was incorporated to the bilateral cooperation in 1999. Initially a plan for 7 research protocols was proposed to KI investigators. Later, two proposals intended for graduate training of 2 academics were presented to the KI. This plan did not prosper. A budget of 46500 USD for April 2000 to March 2001 was approved for supporting 3 projects, short training courses and purchasing books, computer hardware and software. The projects were: i) Comparative analysis of the mortality in the central and occidental regions of Nicaragua ii) Quality of reporting plaguicide intoxication in 10 Nicaraguan municipalities; iii) Allergies caused by mosquito mesh impregnated of piretroides. With the same funds 6 projects related to HIV and sexually transmitted diseases were performed by the Graduate School in Reproductive Health. Two students (D. Hernández and S. Cuadra) will be incorporated to Lund University. A new proposal for research, training and purchasing of equipment and materials was sent to Sida/SAREC on April 2001.

8.2.3. Significant Achievements (UNAN- Managua)

As this program is still very new, it is too early to make any evaluation of whether they have managed to achieve the proposed objectives. However, even at this stage there are some interesting achievements worthwhile to be mentioned. The part of the program located at CIGEO has managed, in rather short time, to establish itself. The individual research projects are clearly defined, each student has a quite clear vision of their commitment, and the individual plans seem to be realistic, both for courses and research activities. CIGEO and CIRA have established a good collaboration within the program. In the two topics in which CIRA and CIGEO are collaborating, a clear division of work among the various students is observed. This means that they are not totally dependent on the results obtained by each other, but rather that the collaboration is adding value to the activities of the students. The distribution of tasks for the Sida/SAREC students at CIGEO and CIRA is adequate, dedicating from 60–75% of their time on a yearly basis for research related to the bilateral program (taking courses in Sweden and for field work). A good working relation has been established with the Swedish counterparts. The

programs seem to be coordinated in an efficient manner both at UNAN-Managua and at the Lund University.

The Faculty of Medicine is clearly very motivated and enthusiastic of being part of the Sida/SAREC bilateral collaboration. After some initial difficulties last year (2000), with the relation to potential Swedish counterparts and with the formulation of research proposals, the new contact with Department of Ecology at Lund University promoted their initiatives. It was relevant that UMF, taking advantage of previous experiences, visited various Swedish institutions to explore potential cooperation projects and clearly decided the most convenient Swedish institution for their purposes. Positive enthusiastic attitudes toward research are evident as indicated by the number of projects and ideas displayed, and the submitted proposals to Sida/SAREC (see section 8.2.2.).

8.2.4. Significant Drawbacks (UNAN- Managua)

As for all the other Sida/SAREC programs, one major difficulty is to find students with sufficient skills in English. The students enrolled in the Sida/SAREC program have taken English courses at the University. UNAN-Managua is presently introducing English as a compulsory topic for all the five years of the undergraduate programs. Nevertheless, English will remain a major constraint for recruitment of students. Similar to other perspectives, Prof. Bengtsson (Lund University) words revealed commitment but frustration when dealing with UNAN-Managua conditions for research. Again, a central and common problem was the insufficient academic background in specific areas and poor knowledge of the English language. In this context the age of the students in relation to the background was a strong Swedish concern, mainly “at the time of learning new strategies and in studying English”. “The fact that older students commonly have more professional and personal commitments, may hamper the time devoted to study and research activities in Nicaragua and to the time they must spend in Sweden”.

CIGEO has a good and ambitious plan for the establishment of high quality laboratory facilities within their fields of research. According to the plans, each of the Sida/SAREC Ph.D. students will assume the responsibility for one of the laboratories. This strategy obviously is very risky, as they will be extremely susceptible and dependent of each single Sida/SAREC graduate to remain “faithful” to the CIGEO. Trying to spread the resources too thinly in order to cover too many areas will contribute to diversity but not consolidation of research groups. The research topics in environmental and occupational health, selected by the Faculty of Medicine are closely related, to the ones already established at UNAN-Leon. The impression of the team was that in Managua they are not aware of what studies UNAN-Leon carries out. It is questionable if Sida/SAREC should fund similar projects in two different Universities not collaborating, despite the fact that research interests are very similar. In this regard, it is too early to enter into research competition between the Nicaragua Universities, when collaboration should be the rule at this stage.

8.2.5. UNAN- Managua Recommendations and Lessons Learned

Even though it is too early to draw conclusions regarding the UMF cooperation, there are a few indicators that have been taken into consideration. In perspective and commensurate with time, several points of UNAN-Leon recommendations seem to be also pertinent for the UMF (see section 7.4). Some of these recommendations concern sustainability, such as the training and assistance in fund raising, establishing strategical alliances with local, regional and international institutions and the identification of comparative advantages. Others stress the need to diversify the training models and to select students under clear rules and deadlines. Some of the recommendations are related to the official recognition of research activates while others stress issues concerning research equipment. Detail descriptions on these recommendations are found elsewhere (see section 7.4).

It is recommended that the two faculties at UNAN-Managua and UNAN-Leon coordinate their research programs, and if necessary that UNAN-Managua, being the newcomer in the SAREC program, reformulate their reformulates its fields of research.

More focus and pragmatism should follow to the presentation of proposals to Sida/SAREC. Categorization of groups and individuals with clear potential should precede training and projects. Scientific training should precede acquisition of laboratory equipment. We suggest to concentrate in a few relevant projects with local, regional and Swedish participation. At this point, training in Epidemiology linked to diagnosis is desirable over other disciplines. Continuous support for cybernetic communications and Library facilities is recommended.

A strict selection of candidates must proceed in order to increase the chances of success. In this respect I consider necessary to make clear-cut requirements during selection of the Nicaraguan candidates (see section 7.4.), favoring younger students. To achieve this, training could be divided into 2 steps. The first step would be to level up the academic and English language knowledge. This could be done in one of the regional graduate programs (e.g. 1–2 years) with the participation of Swedish counterparts and concluding with a MSc degree. After fulfilling this requirement, students could continue their Ph.D. training in Sweden. This formula has been successfully proven in other Central American training programs (<http://www.daad.de>).

It is also very important that UNAN-Managua links its activities at CIGEO, CIRA and the Environmental Health and Epidemiology programs carried out at UNAN-Leon. To initiate collaboration with more experienced Universities in the bilateral collaboration may favor the outcome of the cooperation and increase the chances of success.

9. UNA evaluation reports

9.1. Report of the Evaluation Mission to UNA. Draft for Discussion

Performed by Léa Velho 2002

UNU/INTECH, Amsterdam, Holland.

9.1.1. A Brief Historical Account of SAREC's Support to UNA

Research activities in agriculture with SAREC support started in Nicaragua in 1980, with a project on red beans developed by the General Directorate of Agriculture of the Ministry of Agriculture (DGA-MIDINRA) in cooperation with the University of Uppsala (SLU). Red bean is one of the main Nicaraguan staple foods, and the objective of this research programme was to increase its productivity.

From 1985 to 1987 the project was gradually transferred to the Faculty of Agricultural Sciences and Livestock (FCCA) of the National Autonomous University of Nicaragua (UNAN), given that the research division of DGA-MIDINRA merged with the FCCA-UNAN (which became National Agricultural University – UNA – in 1990). For this move from the Ministry to the University it was also important that the Swedish counterpart was interested in extending the cooperation to the education area. It was realised that research training of the Nicaraguan participants was important for the success of the programme. Thus, from 1984 to 1987, 2 members of DGA-MIDINRA and 2 faculty members of the University started MSc training within the programme.

In 1987 the partners reassessed the programme and decided to broaden it. They included other crops and disciplines, like genetics and plant breeding, plant health, and renamed the programme Plant Science. At this point a graduate programme was established in order to provide research training for university faculty members. The model adopted was to provide formal academic training (course work)

in Sweden (at SLU) followed by fieldwork in Nicaragua and a final period of writing in Sweden (therefore the name “sandwich” for this kind of training, where fieldwork comes in between two formal periods in a Swedish university).

The training of Masters continued up to 1995 when there was a demand from UNA faculty members to extend the programme to Ph.D. training. This was implemented also in the “sandwich model”, but has extended to different areas besides Plant Science, both at UNA and SLU, including genetic resources, forestry and animal science.

In the last few years (since 1997), support from SAREC has extended to other research related activities besides the formal graduate training of faculty members. This include institutional support and resources made available to projects to meet specific detected needs such as curriculum development – both of which are localised and tend to be discontinued with time. However, another type of support, to the so-called Research Council appears to reflect a significant change in perspective and to point to an increasingly important activity in the future of the cooperation.

Table 1 (see annex 12.10.1) presents the distribution of SAREC’s support to UNA to the different modalities of support, or “projects” (as they are conventionally referred to in the official documents). This report will take each of these “projects” in turn, presenting their objectives, results and commenting on achievements and problems. Points for discussion and recommendations are included when relevant.

9.1.2. Ph.D. Support through the UNA-SLU Programme

9.1.2.1. Objectives of the programme

Since 1987 when the cooperation between SLU and Nicaragua was fully transferred to UNA, the core of the support provided by SAREC has been on research training of UNA faculty members. In order to achieve this, a first phase of the programme was devoted to MSc training. A second phase, initiated in 1995, has the main objective to enhance the research and academic capabilities of UNA by creating opportunities for faculty members to carry out research and by improving their training to Ph.D. level.

The objectives the Ph.D. training programmes are expressed in slightly different ways in the various documents:

- i. In SAREC’s documents and in UNA’s reports to SAREC: “to improve agriculture and forestry production in a sustainable way through research in key areas in agronomy, plant breeding, crop protection, animal science, soil science and forestry; to improve research and teaching at UNA and to make UNA a research university through giving UNA teachers research training leading to Ph.D. exam at SLU and to improve research infrastructure at UNA”
- ii. As in SLU documents: “to strengthen research competence and capabilities at UNA aiming at a better integration of research and academic training and, as the research is conducted mainly in Nicaragua it also gives important results with a direct application in the Nicaraguan agriculture and in the teaching at UNA. At the same time it gives Swedish researchers and students opportunities to gain experience in Tropical Agriculture through engagement as tutors and teachers and, for undergraduate students, by carrying out so called minor Field Studies (MFS) financed by SAREC”.

Although in essence the objectives are quite similar as far as UNA is concerned, in SLU documents it becomes apparent that there is also a learning objective for the Swedish counterparts.

Recognition of the value and importance of knowledge added to the Swedish counterparts by engaging in cooperation with UNA is essential and strategic so that the project can be seen by everyone as a clear

collaboration initiative where benefits go in both ways. When it is pictured simply as a Ph.D. training programme, it gives the false impression that the only beneficiary is the Nicaraguan University and therefore, is more a philanthropic than a cooperation endeavour.

It is striking that awareness of the value of the cooperation for SLU is much clearer for them than either for UNA or SAREC. As a matter of fact, this point was first raised during the collective interview that the 3 members of the evaluation team held with SLU researchers engaged in the cooperation. One of the SLU professors said:

“We have more interest in working in Nicaragua than here.”

And another added:

“This project gives Swedish faculty the opportunity to do research in different environments. I spent 5 weeks in Nicaragua and I have produced and learned a lot by going there.”

One practical implication of the recognition of benefits accruing both ways is that SAREC's financial resources for the Ph.D. programme should be clearly featured as going to both partners. And, the part that goes to SLU, not only covers costs with the Nicaraguan students, but also is used to enlarge their knowledge base.

Another practical implication is that SLU could provide a list of articles published or presented in scientific meetings that result from work conducted in Nicaragua (and which, obviously, does not have a Nicaraguan as co-author).

9.1.2.2. Expected results of the Programme

When asked about what was expected of the programmes, replies tended to concentrate in the following points: a large number of publications in refereed journals, training of PhDs, improvement of laboratory facilities, strengthening of the research environment, participation with papers and posters in relevant international forums, closer relation to the international research community and institutions in a specific field.

Therefore, even if the main objective of the programme is to improve agricultural and forestry production in a sustainable way, results in this dimension are not expected to come directly from it.

I believe that this is a very realistic expectation. Ph.D. dissertations very rarely (if ever) are designed to solve a specific practical problem. There are many reasons for that: real life problems generally need solutions which require interdisciplinary and collective research; Ph.D. thesis are meant to build conceptual, methodological and analytical capabilities and not to solve specific practical problems – sometimes both goals are compatible, but not always...

9.1.2.3. The main areas of research within the programme

The ongoing Ph.D. programme has given support to 12 Ph.D. candidates, 2 of which have already finished (therefore there are 10 Ph.D. candidates in the programme now). They do research work in different research fields, namely: crop production, plant protection, weed biology, soil science, genetic resources, biophysical analysis of natural resources, forestry and animal science.

The titles (some are preliminary) of the dissertations are:

- i. Studies on Bean-Maize production systems in Nicaragua
- ii. Selective weed and ground cover management in a young coffee plantation in Nicaragua

- iii. Dynamics of phosphorus and nitrogen in volcanic soils
- iv. Biophysical analysis of the agriculture at the South Watershed of the Xolotlan Lake
- v. Epidemiology and management of white-fly-transmitted gemini-virus in tomato
- vi. Biology and molecular epidemiology of white-fly-transmitted gemini-virus in tomato in Nicaragua
- vii. Characterisation of genetic diversity in common bean
- viii. Biotechnology as tool for breeding of Ccoyam
- ix. Sustainable agricultural systems in the sub-watershed III of the Managua Lake
- x. Animal nutrition and management
- xi. Integral management of the forest ecosystem in the Chococente Biological Reserve, Nicaragua
- xii. Integral management of the forest ecosystem in the Chococente Biological Reserve, Nicaragua

A reading of the dissertation titles above suggest that research problems deal with questions, crops and problem areas which are, broadly speaking, relevant to the country. Such relevance has always been the objective of the programme and it was much talked about during the interviews.

The general perception of UNA faculty members involved in the Ph.D. training is that their research topic for the dissertation has the potential to contribute to the solution of some specific agricultural problem or may potentially generate knowledge or results of practical importance. Examples of such perception can be found in a number of declarations during the interviews, such as:

“Our main client is the small farmer. When I picked my research problem I had the small farmer in mind and I want my research results to be useful to him.”

“We are working on problems that are real in agricultural production in Nicaragua. This is what motivates me.”

“We need to solve practical problems. If we can solve problems with our research and at the same time get a good publication, all the better. But my objective is still to solve the problem”.

Also, one of the discussion groups formed during the evaluation workshop reported, as the first positive aspect of the cooperation with SLU, the fact that “the Ph.D. theses have picked up research problems which are relevant to the local reality of Nicaragua”.

Despite the above perceptions of the social and economic relevance of these research topics, there is a quite widespread concern among the faculty members interviewed with the fact that the research taking place at UNA has, so far, had a very little impact on local agriculture. When asked how they have reached such conclusions, a few of the interviewed researchers were able to provide indicators to support their assessment. They said that the *extension of adoption of technology generated by UNA* was very small, that there were very few (if any) *projects and agreements of UNA with the productive sector*, that UNA has not produced *manual and information leaflets* for the productive sector.

It is also noteworthy that the reports of the 3 discussion groups during the evaluation workshop pointed out, as a negative aspect of the cooperation, the fact that: “the cooperation is too restricted to UNA”; “there is no dissemination of research results”; “there are no mechanisms to evaluate the applicability of results”; “research results have not been useful to provide answer to (practical) problems”.

In order to cross check this perception with some hard data, I looked carefully at the list of publications linked with the MSc and Ph.D. research works provided by UNA to the evaluation team in June

2001. Of the 16 publications produced by those UNA faculty members who undertook MSc training through the cooperation, 15 are *in English* and were published in academic publication channels. The same applies to 13 publications derived from Ph.D. research.

An explanation for this lack of research results dissemination to “client” groups is given is that “so far, results are in a research phase, the further extension phase is coming in co-ordination with INTA as a part of the future tasks that have to be carried out by DIEP” (see Evaluation of Sida/SAREC support to the research cooperation between Nicaragua and Sweden – Synthesis of UNA).

In connection with this widespread concern, it seems evident that UNA needs to start to prepare itself to face the problem of how to establish closer connections with the productive sector and, thus, reach those social actors whose problems they want to solve. A few suggestions were made concerning this point in the course of the interviews.

First of all, it was pointed out that a process of consultation of stakeholders’s (farmers associations, NGOs, government organisations, etc) needs in terms of research, training and recycling that could be provided by UNA had already taken place (see the item on Research Council below). This was performed with technical support from external consultants in the occasion of the curriculum development and for the creation and establishment of the Research Council.

A few interviewees, however, criticised the above mentioned process of consultation and said that it was methodologically fragile. Indicators mentioned were the manipulation of the number of questionnaires, the lack of training of UNA faculty members applying the questionnaires, the little representativeness of the organisations visited and the lack of a systematic and similar approach by all those applying the questionnaires and making the visits.

It seems, therefore, that the consultation process with stakeholders lacks internal credibility at UNA and additional ways to identify needs, and to establish links with external social groups would be advisable. To this effect, I witnessed an revealing discussion between two faculty members of UNA. One of them said:

“UNA needs urgently to be closer to producer’s associations, to engage in a participative process (meetings, workshops with agricultural producers). The logic of this change is: when the cooperation started, UNA was concerned with training its own researchers now UNA wants to give back to society the investment that was made.

We have done and are doing this, in a certain way: we have made visits to certain areas of Nicaragua, we are organising workshops in NGOs and doing diagnostic surveys as well as identifying needs for training. We are talking with producers and identifying their problems”.

And the other replied:

“This is not enough as an strategic plan. All this is ad hoc and leave us not with very much in order to organise our research activities. UNA has to engage in a more strategic planning, involving various government levels, business and non-business people, in a wider consultation and negotiation process. UNA needs to insert itself in a national project – this is more difficult because it involves many different actors, but this is the only way we can get a direction to our activities so that to contribute to national development.”

The idea that UNA is very much closed around itself in terms of its products is not new. Neither is new the general perception that most research projects, in theory, are relevant to the productive sector and refer to selected geographical areas of the country (see, for example, Rojas & Dahlgren, 1998, p.46, for the same conclusion). There seems to exist, therefore, a paradox between the topics of research pursued and the impact of such research on the productive sector.

This paradox needs to be tackled, its roots and reasons better understood. I have myself suggested explanations for this in my general draft report. Much discussion is needed here with an eye in devising actions for the future. Some ideas, such as “scenario building conferences” and funding of projects in partnership with the productive sector using participatory research methods are also suggested in the draft report. It is argued there as well that the methods and ways people are trained have a marked influence in their future working practices. Therefore, habits developed and acquired during conventional MSc and Ph.D., such as working individually (or at best together with a supervisor) will make more difficult to work in interdisciplinary research teams to tackle practical problems. Therefore, I strongly believe that UNA should think about and discuss internally the idea of identifying, together with stakeholders, a problem area that needs input from research and then mobilise an interdisciplinary research team, on a pilot project (which could also include Swedish researchers), to work collectively, involving also a training component.

I do believe there is a need to change in the nature of research being pursued at UNA: from individual to collective and closer to stakeholders needs and participation – from the identification of the problem to the dissemination of results.

9.1.3. Achievements of the Programme

The cooperation between UNA and SLU over the last two decades has had a considerable impact on the formal training and qualification of UNA faculty members.

This can be easily appreciated in Table 2 (see annex 12.10.2.) which presents the number of full-time faculty members and their highest degrees.

As the information contained in Table 2 (see annex 12.10.2) reveals, UNA has 165 teachers who, being on a full-time contract, are expected to do research. Around 95 teachers (50% of them, adding graduates who are and who are not pursuing MSc studies), however, have had no formal research training besides their university degree, although 22 of them (13% of the total) are enrolled in Master programmes. Therefore, in the short run it is expected that UNA will have 55% of its faculty members as Master degree holders.

During the interviews with university officials it was stated that UNA is struggling to have all its full-time teachers to obtain at least a Master degree. When asked how they intend to that since they do not have yet an academic career that reward training, formal degrees and scientific production, it was said that, the academic career is being planned and the teachers have now the opportunity to pursue graduate studies at UNA itself, what makes things easier.

Teachers who have already obtained their MSc degree amount to 65 (39% of total). It is clear here the significant role played by SAREC in contributing to the training of 17 of those Masters (about 26% of all UNA MSc teachers were involved in UNA-SLU cooperation programme). It is also worth mentioning that, in fact, 22 Masters got their degree in the framework of SAREC's programme, but 5 are not working at UNA anymore. Except for one who passed away, the other 3 work for the Ministry of Agriculture and are important links of government to UNA, and 1 has left the agricultural sector. Therefore, the picture shown by the numbers in Table 2 (see annex 12.10.2.) is that UNA has been able to retain its qualified Masters to a considerable extent and that those who left have become important partners and links, what is also a desirable impact of the cooperation.

At this point it is important to ask: what about the 17 Masters trained who stayed at UNA? Have they become committed to research? Have they continued their formal qualification in research and headed for the Ph.D.?

The answer is: some of them – 6 of former MSc trained in the context of the cooperation are also enrolled in the Ph.D. programme. Therefore, out of the current 10 Ph.D. candidates partially funded by SAREC, 4 are Masters from SLU and 2 of the 5 existing PhDs have received both their MSc and Ph.D. degrees from SLU.

From what was just said it is also clear that SAREC support has had a considerable impact on the training of PhDs as well: 2 of the 5 existing PhDs got their degree in the framework of the programme, as already said. More significant, however, is that of the 12 teachers pursuing Ph.D. studies, 10 are enrolled in SLU (all of the male Ph.D. candidates and 1 of the 3 female Ph.D. candidates).

Two questions should be raised at this point and discussed by UNA: Why is it that 11 SLU trained MSc have not continued their formal training towards the Ph.D.?

What are the implications of having such a high inbreeding rate among formally qualified researchers? (I refer here to the fact that when the current SLU PhDs finish, UNA will have 15 PhDs, who will certainly be the scientific leadership of the university, and 12 of them will have been trained at the same university in Sweden.)

A striking figure of Table 2 (see annex 12.10.2) is the considerable difference in formal qualification of male and female teachers. While 60% of women are graduates only, the comparative figure for men is 38%. In a similar way, 48% of the male teachers are MSc degree holders, but only 26% of female teachers have the same degree. Finally, all 5 existing PhDs at UNA are male. In this respect, SAREC support has not being different from the general trend: the MSc programme has trained only 2 women out of 22 enrolled. Of the 2 women, a left the university and the other is now the only female Ph.D. candidate supported by SAREC. Therefore, during the existence of the cooperation UNA has just 1 female teacher trained under the SLU programme, both at MSc and Ph.D. levels.

This is not a new finding. It has been widely recognised by SAREC and also by UNA and SLU that something had to be done in this respect. The reasons frequently put forward are that fewer female than male teachers dominate the English language which is a requirement for enrolling in the programme. If this is true (and it was repeated over and over during the interviews), it is hard to understand why measures have not been taken yet – things like selecting the best candidates, irrespective of their knowledge of English, and then supporting their training in English were also consensual during the interviews.

Another common explanation is that women, given their family responsibilities are less mobile than men and, therefore cannot go abroad to study and leave the family behind. I have argued elsewhere that sandwich training is particularly hard on women and that it is more likely that a woman will face a full doctorate abroad (taking the children with her) than travelling back and forth and leaving the kids behind. Gender differences historically accumulated will not go away without higher investment and pro-active attitudes. Therefore, I strongly believe that UNA has to put forward a serious assessment of what is holding down its female teachers, with an eye to a plan in the short and medium term to remedy this unacceptable gender differences in terms of opportunities and achievements.

In short, if it is reasonable to assume that MSc degrees do qualify people to perform research activities, it may be said that UNA can count on 70 researchers. By this mere sheer number, is it possible to say whether or not UNA has been able to achieve a *critical mass* of competent researchers?

Critical mass of researchers is one of those terms that are of general use in the field of S&T but which is seldom defined. Looking at the specialised literature, critical mass is defined as “a group of researchers working on a speciality or research problem-area, who are able to mobilise the necessary human, material and financial resources to carry out their research activities in acceptable quality standards.

They should also be able to perform well without depending on permanent external inputs and to reproduce themselves.” (Barreiro, 1997, p. 138).

What is also pointed out by the relevant literature is that very few countries and very few universities have been able to develop critical mass in all scientific fields and specialities. Most common nowadays is for countries and universities to select a few specialities and problems on the basis of their needs and vocation and concentrate efforts in forming critical mass in those.

With the above definition in mind, we can try to analyse whether or not UNA can count today with a critical mass of competent researchers. The answer seems to be *not yet*, for a number of reasons:

- i. Those with Master training seem not to be very active in research. A few indicators giving support to this assertion are: the number of proposals submitted to the Research Council was very small and, more important, the quality of the proposals was so poor that only 3 reached acceptable standards for approval in 97, and only 15 were being pursued in 2000; only 4 Masters (out of 65) have projects funded by the Research Council.
- ii. The Masters trained by the UNA-SLU programme publish very little by whatever means. Their publication list reveals that the 22 Masters produced 16 articles which except for 1, were published in in-house series (either at SLU or UNA) and therefore, have not been submitted to the normal selection criteria of refereed academic journals. The exception was a one publication in *Tropical Agriculture*, which has a Swedish researcher as first author (I have no information about publication of MSc degree holders trained in other programmes).
- iii. The evidence seem to point to the non-existence of research groups: most research proposals are individually submitted and the great majority of articles both by Master and Ph.D. candidates are single-authored (the ones in co-authorship involve student and supervisor relation and not partnerships within UNA).

In view of the above, if MSc degree holders are not writing research proposals, when they do they do the proposals lack quality, and if they are not publishing the results of their research, then it seems reasonable to conclude that they have not yet reached critical mass. (I am assuming that Ph.D. candidates do not need to submit research proposals because they have assured funding for their Ph.D. research).

Having said that, it is important to clarify that there are signs that UNA is going in the direction of creating critical mass of researchers and a stimulating research environment. Examples of such signs are:

- i. Ten PhDs are in line to finish in the next 3 years. They have already began to show a significant scientific production in refereed journals (1 in *Agronomy Journal*, 1 in *Plant Disease* and 5 others submitted, plus 1 chapter in a FAO book).
- ii. New Ph.D. candidates have been selected to work in teams and arrange seminars together so as to get a more problem-oriented insight – this is the case of the 2 working on white-fly and virus transmission as well as the two working on forestry. These two pairs may well be the beginning of research groups in their specific problem areas.
- iii. Recently 2 UNA researchers who obtained their MSc degree through the UNA-SLU programmes were very successful in the research competition of FAITAN, being the winner of 2 projects out of the 5 approved in total (FAITAN is the competitive funds for investigation and technology transfer – it is a national competition with funds from IDB).

iv. Laboratory facilities have improved regarding biotechnology and molecular genetics and other basic facilities for research.

v. Regular research seminars are being held at UNA with high attendance rates. More significant is that seminars are given by UNA researchers themselves and do not rely on visitors only as it used to be the case.

vi. An impressive number of undergraduate students are involved in the research work of the Ph.D. candidates: 186, according to the document prepared for the evaluation mission. Of course not all of them decide to do their graduate work within the project, and make the exam option to graduate (which, according to many interviewees is a serious problem that UNA has to face: the fact that students are every time more preferring to take graduate exams than to do research or monographic work. And, more serious is that they enrol in a paid course to prepare for the exam). Some of those involved in the projects do decide to write a research piece – in 2000, 14 undergraduates presented their dissertations under the supervision of the Ph.D. candidates.

vii. Finally, “an important product of the cooperation with Nicaragua is that we have now institutionalised research as an important activity at UNA”.

9.1.4. Interaction between UNA and the Swedish Counterpart

From all available documents as well from interviews with both the Nicaraguan and the Swedish researchers involved in the cooperation, the impression one gets is of a smooth and trusted relation. No conflicts of any kind are apparent.

Most significant is the consensus among UNA Ph.D. candidates that they have decided on their research topic, that all main research decisions are shared between the parties.

Despite of this, it seems reasonable to argue that in a student-supervisor relation there is a certain degree of dependency that goes from the less to the more qualified. This is also accepted from both parts.

It should be mentioned that from both sides there is a clear commitment for a long –lasting cooperation, even after the PhDs finish their work. The words of a Swedish researcher sums up the idea and reflects well the general feelings and expectations:

“I see the future as UNA being able to create and maintain a good quality MSc and Ph.D. programme. We will support them in doing that by giving out our experience of how to be a supervisor, how to manage a Ph.D. programme and other things. But, even when UNA has done that the cooperation will remain because science is about international cooperation and it is crucial that this is maintained also for the sake of the Swedish researchers. Therefore, in 10 years I see my Ph.D. students and the Ph.D. students of current Nicaraguan Ph.D. candidates co-operating and working together. They will be filling applications for research funds together”.

The only point of insatisfaction revealed by the interviews has to do with management of funds which are, in terms of budget, to pay accommodation of UNA researchers when they are in Sweden. A few of the students felt that the arrangements for their living are not always satisfactory – they would prefer to have the choice and pay themselves for it.

9.1.5. Institutional Support

According to the interviewees, in 1997 it was felt necessary, for the creation of a research environment, to strengthen UNA's capabilities in administration, communication and working conditions, so as to create an environment more conducive to research. Having this in mind, an institutional support

project was created and implemented, composed of three parts: Information and communication technology, Working conditions and equipment, increase of managerial capabilities.

Table 1 (see annex 12.10.1) shows that in the years 1998 and 1999 (26 and 13 percent of the total support, respectively), this modality of support comprised a much higher proportion of SAREC's support to UNA than what had been the norm (around 6%). However, as the figures for years 2000 and 2001 reveal, institutional support has already decreases substantially and will not cover, in the future, items that were approved in the two previous years, details of which are given below.

9.1.5.1. Information and Communication Technology

There was considerable improvement in the availability of communication hardware and software (both for management of the university, providing computers to the offices of Faculty Deans, financial directorate and Library). Special mention should be made of the internet connection in the university Library (CENIDA). A special IT project has being designed and is being negotiated.

9.1.5.2. Working Conditions and Equipment (Research Environment)

The most noteworthy result of the institutional support that was granted in recent years for improving working conditions and strengthening the research environment was the new Laboratory for Molecular Biology which was opened in December 6, 2000. Resources were provided by SAREC to rebuild and repair physical installations and infrastructure, as well as to purchase necessary equipment, which was done through SLU. Resources were also provided to restore the building of the Seed Laboratory. I had the opportunity to visit the two laboratories and they seemed busy and functioning well. According to the interviewees that were using the labs for research purposes, they are now able to perform analyses which were not feasible in the prior conditions. However, it was not clear whether the labs will be used for undergraduate teaching courses – it was suggested that the laboratory cannot accommodate large undergraduate classes, but is open to undergraduate students who are willing to do research in the area for their graduation degree.

It is important to mention that this kind of support has been terminated by SAREC for the near future. According to the documents of plans for 2001 and after and according to UNA faculty members interviewed, laboratories will be built only in connection with training. I believe this should be further discussed with UNA. What is needed for the Ph.D. research work in terms of equipment may be very specific and far from what would be needed in a lab for teaching and collective research. It seems to be more useful in terms of fostering a research environment at UNA that the purchase of lab equipment could have a more collective and not individual orientation.

9.1.5.3. Efficiency and Transparency of the Administrative and Financial System

Special funds for increasing UNA's management capacity were motivated by the realisation that UNA was facing problems such as: lack of internal financial control, lack of control of fixed assets purchased with project funds, lack of adequate documentation to support disbursement of project's funds (caused by a lack of adequate supervision and control by the financial directorate; lack of adequate control over advance payments made to officers for disbursement, acquisition of equipment and travels abroad. Also, it was realised that UNA did not maintain a data base of teaching and administrative personnel and therefore was difficult to plan for the future and to monitor developments.

This, according to the interviews, have been solved by totally re-structuring the financial directorate (a new director was hired) and training officers and supporting personnel, carrying out an special financial audits and implementing the recommendations of the audits report. This included the performance of a physical inventory for all UNA's fixed assets and a much greater supervision from the finance

directorate with the purpose of obtaining the corresponding documentation to support payments and expenses. During the interview, the financial director said that settlements of advance payments for people travelling for the Ph.D. are now timely requested but not always timely attended. A complain (which also appeared as negative aspect in the reports of the discussion groups during the evaluation workshop) is that resources from SAREC are often late (see report of Group 3).

Another clear improvement in the managerial capability of UNA was the inventory of UNA faculty, with details in terms of background, degrees obtained and where, working categories, years of teaching experience, number of publications, awards and grants received, etc. This information is now available for each faculty member and can be retrieved by School, department and speciality.

This is a basic tool from which to start assessing needs in terms of human resources for teaching and research, to start thinking about an academic career and the criteria for promotion, etc.

It seems that the support granted to improve administrative and financial capabilities at UNA had considerable impact. This is the most consensual point among the interviewees. The following statement of one the SLU researchers is representative of the general perception of interviewees concerning the improvement of managerial capabilities at UNA:

“The management of research funds of UNA is working very well since 2 years. Administration is now quite efficient and dynamic.”

However, what I found striking when talking with UNA's faculty members and officers, was that they tend to attribute the achievements exclusively to the support granted by SAREC. There is an apparent lack of awareness that for each of the modalities of support granted by SAREC there is also considerable local investment (financial, material and human), without which no progress could be done.

In view of that, I believe it is absolutely paramount that in the financial report of each SAREC project, it also appears the amount of national funding with a clear discrimination of what is included. For example, in the case of institutional support project, UNA invested a significant amount of financial resources in terms of salaries of personnel involved, utilities provided, physical infrastructure, labor, etc.

In the case of the Ph.D. project, also there is considerable investment from UNA (salaries of faculty members who are 80% of their time dedicated to their training, use of university facilities when Swedish researchers go to UNA, use of university paid drivers to SAREC projects, etc), as well as in all other projects. When such investments are clearly spelled out and *made public* to the community within and outside UNA, it is possible to contextualise external support and aid and see it in the light of local, national public spending.

9.1.6. Research Council

El Consejo de Investigación y Desarrollo (CID) will be here referred to by its older name in English, that is, Research Council.

The research Council is composed by the deans of the four Faculties comprising UNA, namely Animal Science, Environment and Natural Resources, Rural Development and Agronomy and by the Director of Investigation, Extension and Graduate Studies (DIEP).

The Research Council is the directing board of research activities at UNA. It has the objective of co-ordinating research activities of UNA so as to ensure that they will contribute to agricultural development and, at the same time, strengthen scientific and technical capabilities (both material and human) of UNA. Ultimately the Research Council aims at promoting a scientific environment at UNA

so as to make sure that the University can, by means of research, provide answer to practical problems of agricultural production.

In order to achieve this, UNA led a process to identify problems and needs of agricultural production in the country, which involved farmers association and other agricultural organisations, both at the government and non-government level. Such process was carried out through workshops, discussion groups and visits to production units and associations by UNA faculty members.

The information collected was analysed and a synthesis was produced by UNA and discussed with members of the other participating institutions for comments and amendments. As a result, UNA identified 3 main problem areas (Management of Watershed; Improvement of Income of Rural Families; Development of Agricultural Productive Capacities) where research should concentrate. Of course, each of these 3 problem areas are very broad and allow the most varied research questions and approaches. In order to avoid that, the Research Council has produced terms of reference for each problem area, therefore identifying the types of research questions that will be given priority for funding.

Funding is provided on a competitive basis through call for proposals co-ordinated by the Research Council on the priority areas listed above. Eligible researchers are UNA faculty members or members of other organisations doing graduate work at UNA and supervised by UNA professors. Proposals are reviewed by experts both from UNA and from external institutions who will also monitor and evaluate the selected and approved proposals during and after their implementation. Results are to be widely disseminated internally in the country for the various stakeholders in the agricultural sector.

Applicants to research funds of the Research Council may aim to the amount of about US\$ 2,000 for project. This amount may be used to cover costs with fieldwork, scientific literature, minor equipment and transport. Besides funding research projects, the Research Council may also cover short-term specific courses and seminars (identified as needed by UNA faculty members) and dissemination of research results (participation in scientific meetings and publications). The Research Council began its operation in 1997 (with resources from SAREC) but the quality of the proposals was said to be so poor that only 3 projects were funded. The number of approved proposals increased to 7 in 1998. By December 1999, 15 projects were totally or partially funded by the Research Council, a few of them still on-going in 2000 and 2001.

A summary of the activities funded by the Research Council up to 1999 (last available information):

Research projects: 11 research projects were funded – of these, 6 were individual projects, 4 involved 2 researchers and 1 involved 3 researchers. This means a total of 17 researchers funded – Of the 17 researchers, 1 was a doctor, 4 were MSc degree holders and the other 12 were graduates (Lic. or engineers).

It is revealing that UNA has 165 professionals involved in teaching activities, of which 65 have Masters degree and so few have submitted research proposals to the Research Council (or have been approved – I had no access to the number and a listing of the submitted proposals). This has already been discussed above in the item *of critical mass*.

In sum, the results above indicate that the Research Council, so far, has not been so successful. However, it is expected that since Ph.D. candidates have begun to graduate in 2000, and they certainly will need small research grants to ensure the maintenance of the created research capacity and environment, the number and quality of the proposal submitted to the Research Council will increase.

I believe UNA is correct in expecting that, but I would like to make a number of points for discussion in connection with this:

- i. I believe it is a serious problem that the Research Council is geared to fund small and localised projects. This will reinforce the isolated research activity and not foster partnerships, collective and interdisciplinary research.
- ii. Support of individual projects instead of collective projects stimulates competitiveness instead of cooperation and interdisciplinary. Despite a healthy component of competitiveness, in a weak research environment it tends to create too much personal rivalry. It is much more productive to find ways for people to join strengths and work together in interdisciplinary projects geared to a common problem.
- iii. The competitive individual project model may create a “halo effect” whereby PhDs will be in a much better chance to win, since they are more qualified.
- iv. Suggestion: call for proposals (with the most substantive part of the funds, say 70%, leaving 30% for participation in scientific conferences and short courses) should be in very specific problems and projects have to show networks and a training component and a collective research effort to tackle the problem.

9.1.7. Curriculum Development

UNA was able, in part with support provided by SAREC, to undergo a considerable re-structuring of the undergraduate offers in terms of careers, course requirements and course contents. Courses are now based on constructive model and have been organised in 8 undergraduate careers and six graduate programmes at the MSc level.

The reform had just been implemented during my visit. Although it looks well thought of, well managed and seems to reflect society’s needs (it followed a diagnostic of stakeholders’s needs), it is yet too early to assess its achievements, impacts and problems.’

It is envisaged that, its being successful, will have an impact on the number of drop outs, on the number of egressados, it will increase application number of new entrants and it will, at the end, result in more and better job offers for the graduates. This is planned to be closely monitored by the Teaching Directorate (Dirección de Docencia), according to the interview with the Director.

The most important indicator of success, however, will be the approval of the undergraduate programmes by the Central America Accreditation System which has been established and is working on criteria and procedures.

9.2. Evaluation report of the National University of Agriculture (UNA)

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9.2.1. Methodology (UNA)

9.2.1.1. Plan (UNA)

A direct structured interview was performed in Uppsala with Swedish tutors from the Swedish University of Agricultural Sciences (SLU) and four Ph.D. Nicaraguan students from the National University of Agriculture (UNA). Individuals spoke freely during the two hours interview. The general written comments and indications were pondered and compared with the responses and commentaries to the questions raised in the direct interviews. A panel of five questions (see annex 12.14.1.) was given to 5 groups composed between 5 to 10 UNAN-Managua academics. Groups discussed for 2 hours, answered the questions and resumed their findings in a 15 min oral presentation and in two-four written pages. Two different questionnaires (see annex 12.13.) were given to academics involved in the

Sida/SAREC cooperation. Questions were divided in four clear-cut categories to facilitate the quantitative analysis. Questionnaires were filled anonymously, included in a close envelope and personally collected by the evaluators. In addition one section for general commentaries (1/2 page) was allowed. Specific qualitative questionnaires were given to the team leaders of each group (see annex 12.13.).

A second workshop with academics and students from UNA and two members of the Swedish team (Prof. Lars Ohlander and Dr. Marie Nyman) was performed in Managua Nicaragua during our visit in February 2002. This workshop included oral presentations by the UNA representatives and a general discussion on the conclusions of the preliminary Velho's evaluation. Working sessions following the method of "reflecting teams". Briefly, reflecting teams were organized in three different groups: Ph.D. students, University authorities including Swedish SLU team leader, and a mixed group of students and authorities. Each session lasted for 25 minutes, according to the following protocol: groups from 5 to 7 individuals were located in the center of the room, facing each other, in the sense that they could not face the audience which was disposed around this group. A panel of three themes, each one including from 3 to 4 questions (see annex 12.14.2.), was put forward for discussion. The first group discussed the first theme, the second group the second theme and the third group the third theme. Only the members within the group could discuss the questions. One secretary was appointed for taking notes, which later were typographically transcribed and handed to the evaluators. After concluding the reflecting team sessions, a general discussion was carried out. The evaluators did not participate in the sessions or in the discussions. Each working session lasted from 2 to 3 hours.

9.2.1.2. Scope and Limitations of the UNA evaluation

The bilateral collaboration between UNA (initially in the form of the Faculty of Agricultural Sciences and Livestock (FCCA) in UNAN) and SLU has already lasted for 16 years. The ventures carried out by these two institutions have varied in time and the collaboration has evolved. Even though we understand this, the present study concentrates mainly in the efficiency of training, efficacy of the collaboration between the Swedish and the Nicaraguan counterparts and in the viability and sustainability of the projects performed within the academic context of UNA.

Prof. Lea Vehlo, who visited laboratories and carried out direct interviews with the various Nicaraguan research groups, students and administrators participating in the bilateral cooperation, performed the first part of this evaluation. Her insights regarding the collaboration between UNA and SLU have been written down in a preliminary report included in this study and to which we will refer through out this manuscript (see section 9.1). Due to the fact that we (E. Moreno and T. Alveteg as the remaining members of the evaluating team) did not participate in the individual interviews or laboratory visits at UNA, we encourage the reader to revise Velho's report for specific insights regarding personnel, research groups and laboratory facilities. In this sense, we have extracted most of our information from group interviews, workshops, publications, evaluations, progress reports, proposals, Sida/SAREC publications, commentaries regarding Vehlo's study, and direct recommendations written from UNA and SLU. More details and general perspectives regarding the complexities of the Nicaraguan public University System are found in the general evaluation were this study inserts. In addition, a brief historical account of the Sida/SAREC collaboration to UNA is found in Prof. Velho evaluation report (section 9.1.). Additional information on the first years of the collaboration are found elsewhere [Ganuza, E. 1988; Larsen P. H. 1990].

9.2.1.3. Acronyms Used (UNA)

UNAN, Autonomous National University of Nicaragua; FCCA, Agricultural Sciences and Livestock of UNAN; UNA, National University of Agriculture; SLU, Swedish University of Agricultural Sciences; IFS, International Foundation for Science; TWAS, Third world Academy of Sciences.

9.2.2. Findings (UNA)

9.2.2.1. Brief Background (UNA)

Sida/SAREC support to National University of Agriculture (UNA; then as the Faculty of Agricultural Sciences and Livestock, UNAN) was initiated with a MSc. program developed in cooperation with the SLU in 1983. The "open-sandwich" Ph.D. program (see details below) between UNA and SLU initiated in 1991, on the basis of MSc. graduates in previous years. During this second period, however, the cooperation between these two institutions developed not only to train Ph.Ds, but also to strengthen the physical facilities for research (e.g. Library and laboratories) and to establish adequate administrative systems and management of funds. The collaboration between Sweden and UNA ought to be recognized as a bilateral inter-institutional cooperation in which SLU constitutes the only Swedish academic counterpart. This collaboration has been marked by the strong commitment of the SLU academic group under the leadership of Professor Lars Ohlander who has clearly and explicitly conceived this cooperation as a long-lasting enterprise between these two institutions:

"When SAREC requested my participation in this (bilateral cooperation) project (with UNA), I made quite clear my conditions: I was willing to participate only if SAREC was ready to support this enterprise for no less than 30 years; otherwise I was not interested. So far SAREC has kept its word... so do I "

This strong commitment of the Swedish SLU members was demonstrated through the interviews. It has also been demonstrated in various comments and responses given by the Swedish tutors to the evaluations written by Prof. Velho, who participated in the first part of this study (see section 9.1.). In time, the fundamental principles and strong commitments of the SLU group has permeated the UNA academic environment, as expected from this long-lasting training program. Concomitantly, the Nicaraguan students that have participated in the MSc. and Ph.D. "open-sandwich" modality have also imprinted the Swedish academics in a positive manner. This dialectic experience has made the collaboration fruitful, has increased the chances for future development of research capacity in UNA and has opened opportunities to the Swedish counterparts to explore interesting scientific questions.

9.2.2.2. Positive Outcomes (UNA)

Several positive aspects derived from the UNA-SLU collaboration have been already indicated in Velho's report (see section 9.1), and will not be repeated here in detail, but complemented. One of the most obvious positive outcomes of the collaboration has been the favorable impact that the MSc. and Ph.D.s SLU graduates have had in the academic and research environment of the Nicaraguan University. In turn the MSc. and Ph.D. graduates have influenced the UNA careers by introducing modern scientific concepts and upgrading future professionals in current technical skills, presently used in agroindustry and forestry . By agglutinating a considerable number of students around different research and social-oriented projects, the SLU graduates have reinforced the "on ground" training, and established an adequate framework for local graduate (MSc.) programs. This training system has been a good model and several UNA students are already committed to perform graduate studies locally and abroad, generating by this a favorable academic chain reaction. For instance, incorporation of students in these "on ground" projects has constituted an excellent strategy for permeating future professionals in the most relevant problems that the Nicaraguan agroindustry confronts; this practice eventually will serve to identify the comparative advantages for the elaboration of competitive future research projects. Moreover, most of the young graduate students currently enrolled at SLU, have had a positive influence on freshmen students by demonstrating an appropriate academic training and adequate English language command. As expressed by one of the SLU professors:

“Command of the English language by the (Nicaraguan) students, constitutes a significant advancement with respect to previous years and demonstrates a positive outcome in the evolution of the training model”.

Although this may sound trivial to the ears of academics from well-developed Universities, English knowledge, or more precise its absence, has been a significant drawback that has slowed down the advancement of science in Nicaragua.

Joint academic ventures for the development of courses at UNA already started by the various SLU graduates. These joint activities may provide a framework for initiating collaborations in research. Establishment of satisfactory units for supporting research activities, such as the Molecular Biology laboratory and the subscription to 17 international scientific journals, has been a significant achievement. Mainly when these units were designed to serve various research groups rather than to serve individual demands. Linked to this is the access that students have to computers and cybernetic communications such as high capacity laptop computers, Internet and e-mail communications [UNA 2000].

A common aim written in most proposals, reports and recommendations refers to the improvement of “agriculture and forestry production in a sustainable way through research”. Although sustainability in these areas is far from being reached, important actions toward the solution of specific problems are currently being performed. The fact that most Ph.D. research topics are related to the management, production and plague control of important crops in Nicaragua constitutes a positive sign. Ownership of research topics has been an important factor developed during the collaboration. In addition, strong efforts to link UNA research activities with stakeholders and society are evident (see annex 1.10.6., Table 6).

The dynamics and organization of the training period in Sweden has been very rewarding and motivating for the students according to some of the personal interviews in Nicaragua and Sweden as well as to some of the written material collected. By looking the annual progress reports and proposals, planning seems to be well organized with clear-cut deadlines (see annex 12.10.3., Table 3). In addition, training has not been subscribed exclusively to Sweden and Nicaragua, since most of the students have been scheduled for seminars and training periods in third countries (see annex 12.10.3., Table 3). This is a very important exercise, since the pool of students graduated in SLU has opportunities to appreciate different academic and research environments, other than Sweden and Nicaragua. Special care has been taken in training people in different areas, trying to maximize the expertise. Diversity of individuals trained in different areas constitutes an advantage in a short term. Although on a broader panorama too much “atomization” of training without repetition in specific areas, may revert into an obstacle for the consolidation of a critical mass of investigators.

The incorporation of a Research Council composed by the Deans of the four faculties of UNA is also a positive sign in the consolidation of science in this Institution. The Research Council has been enthusiastically devoted in supporting with small funds (up to \$2000) individual research activities, finance courses and seminars, cover the expenses for the dissemination of scientific results in meetings and publications. Details on the analysis of the financed projects are found in the evaluation performed by Prof. Velho regarding UNA (see section 9.1.).

One relevant landmark in the UNA-SLU collaboration has been the participation of Nicaraguan and Swedish coordinators who serve as a link between the students and the projects. Experience has demonstrated that “sandwich” models are more efficient when there is a local coordinator and a group of local tutors responsible for the students, research activities and administrative matters [Nieto 1996; <http://www.NeTroopica.org>]. If there is not a local tutor for a closed “sandwich” alternative, then the local coordinator plays a very important role in the follow-up the academic and research activities and

communication with Sida/SAREC and Swedish counterparts. However there are several conditions that the local coordinator must fulfill (discussed below).

The future graduation of Ph.D. students will eventually contribute to increase the pool of potential UNA tutors for students subscribed in the "sandwich" program, favoring by this manner the transition from an open to a closed "sandwich model". In this direction the comments of the UNA-SLU annual report are explicit:

"The programme as a whole is working well. A good understanding between the two cooperating partners, UNA and SLU, and the donor Sida/SAREC has been established over the years. Contacts between the students when they are at UNA and their supervisors at SLU functions well. The coordination of the programme and the contacts between the coordinators at UNA and SLU have been smooth and unproblematic."

Finally, according to our interviews with both, UNA and SLU interacting teams it also seems that the administration procedures and the management of funds regarding the bilateral cooperation have greatly improved in UNA during the last years.

9.2.2.3. Drawbacks (UNA)

The collaboration between UNA and SLU supported by Sida/SAREC, has to be judged on the light of the circumstances prevailing after the Revolution when the Sida/SAREC initiated its support to FCCA (later converted to UNA). We are aware of the efforts that both parties have made to resolve the myriad of difficulties inscribed in this study. We also understand that these changes require time. Several of the drawbacks indicated here have been partially solved and, therefore, the differences with previous years are in magnitude rather than in origin. Similarly, new problems have emerged as consequence of the dynamics of the collaboration, while others remain the same despite the efforts, or just because urgent matters are ahead of priorities (e. g. education versus fund raising). Is within this perspective that our recommendations must be seen, considering that the compelling goal is to solve them. Solutions may come from positive experiences obtained in other latitudes, from native findings or by a combination of both. In general terms, the drawbacks detected are divided in four main subjects: problems related to sustainability, problems connected to training and research, problems associated to the administration and to the infrastructure, and problems related to the linking of research with stakeholders and society. Although these four categories are discussed separately, the reader will find obvious connections among them.

9.2.2.3.1. Problems Related to Sustainability (UNA) Similar to other Nicaraguan Universities, the major problem detected in the bilateral collaboration with UNA refers to sustainability. The UNA projects supported by Sida/SAREC are very much dependent on the Swedish cooperation and without this assistance all research activities, laboratories, training programs and Library facilities would dramatically deteriorate in a short time. It is also likely that under these circumstances, the qualified personnel would move from the University in order to find better alternatives.

Establishing a research capacity and founding a critical mass of investigators is much more complex than generating a pool of MSc. and Ph.D. graduates. It is clear that a lot of effort has been put into the specific academic instruction of the UNA Nicaraguan students. However, it seems that little expertise has been gained in granting processes, in strategies for writing research proposals and in the elaboration of scientific reports. Other deficiencies detected were connected to the absence of strategies for obtaining better research opportunities, gaining collaborations and establishing international interactions. Notwithstanding the arguments of some Swedish and Nicaraguan investigators, the truth is that very few scientific reports in peer reviewed international journals have been signed by the UNA investigators participating in the collaboration (see annex 12.10.4.; ISI Philadelphia, EUA, CD-ROM

2001). In addition, besides the few local individual proposals submitted to the Research Council (see section 9.1.), no written or international proposals were detected. For instance, in a search comprised over a twelve-year period (1990-2002), not a single UNA research proposal was registered in the International Foundation for Science (IFS) nor in the Third world Academy of Sciences (TWAS), both granting agencies within the field of interest of UNA (<http://www.ifs.se/>; <http://www.ictp.trieste.it/TWAS/>); <http://www.ifs.se/>;). Apart from the bilateral cooperation with SLU, no other international funded or economically supported local research collaborations were detected; despite the fact that most students have had the opportunity to visit other research groups abroad [see project activity plans for the Ph.D. students, UNA 2000]. Moreover, very few intra-institutional joint proposals or inter-institutional joint research ventures have been detected (for detail discussion see Research, section 9.1.).

In addition to the points cited above, there are other elements that add to this general problem. Even though UNA academics are enthusiastic with respect to scientific activities, they do not show dynamic and practical attitudes toward fund raising and making research sustainable. In several occasions fund raising, sustainability and cooperation issues were brought into the discussions in the various workshops (see annex 12.14.2.). However, with exception of a few timid and general propositions such as "Redefine and reconsider the philosophy of sustainability ", no specific answers or ideas were annotated by individuals or written down in the recommendations (see annex 12.10.4.). In addition, no distinct perspectives regarding the needs of concomitant fund raising or gaining economical independence in research enterprises were observed. For instance, to the question of "when should the bilateral collaboration be finished?" one of the given written answers was "When UNA (*gains*) the ability to get funds from different sources; only after that can the Swedish cooperation be retired". That means that the Sida/SAREC collaboration is not seen as a complement but as prerequisite. Moreover, in two occasions, different UNA authorities and SLU graduates participating in the collaboration expressed their negative opinion with respect to their involvement in research-based economical enterprises (e.g. charging for diagnostic services or for consultancy). Nobody expressed a different opinion within the UNA group. In sum, several factors hamper the economical independence and the foundation of a critical mass of investigators necessary to gain sustainability in scientific activities at UNA. The restricted combative disposition for fund raising and collaboration, together with the absence of expertise to perform research-based profitable enterprises in a coordinated manner, are among the most important problems that must be confronted. Concerted strategies to revert this situation are urgent and some recommendations have been put forward in the coming paragraphs.

A very complex problem linked to sustainability in research activities is the absence of incentives. The low salary level and the lack of specific rewards that motivate research activities (although, some scientific awards have been established by the International Development Bank and by other institutions) and long term enterprises are the two main challenges that UNA has to confront. It is clear that scientist cannot live on scientific merits alone. Therefore, frequently scientists have to search for better opportunities outside the University or, alternatively, procure second jobs some of them overlapping with University timetable. This problem is aggravated by the absence of recognition of research as and official academic enterprise and by the very reduced number of fund-raising and economical ventures based on research enterprises that could alleviate, at least in part, the lack of incentives.

9.2.2.3.2. Problems Connected to Training and Research (UNA). So far, the training model functioning between UNA and SLU is circumscribed to the open-"sandwich" model (see section 7.3.1.4.). In contrast to the closed "sandwich" (<http://www.netropica.org>), the "open" modality is characterized by the presence of a Swedish tutor in the absence of a local (Nicaraguan) tutor. In this respect, the opened-"sandwich" model has several disadvantages over the closed modality discussed elsewhere [Nieto 1996]. For instance, without the support of a strong local counterpart, the enrolled students are fre-

quently committed (or voluntarily involved) into many teaching and administrative duties with little time for research. In consequence, local research activities are seldom accomplished, trips to Sweden are delayed and planning is not effectively achieved. Moreover, the control of the experimental data and collection of samples become less efficient. Due to low contact with tutors, other abilities, such as writing, reporting and fund raising are more difficult to learn. Finally, the theoretical execution of the research project is mainly under the responsibility of the tutor, putting a lot of constraints on the Swedish counterpart.

One of the major consequences is that complete training from Bachelors (or Licenciature) to Ph.D. training commonly takes between 8 to 12 years to be concluded (from 2 to 4 years to MSc. and from 6 to 8 years to Ph.D.), with exceptions (see annex 12.10.3.). Slow actions in Ph.D. graduation may delay opportunities for well-trained young scientist working at UNA within the framework of the bilateral cooperation. It was detected that in some cases the long-lasting Ph.D. students and Swedish tutors are prone to develop a stage of "extreme tolerance" and a stage of equilibrium, in which no clear decisions are taken. On the one hand tutors have the tendency to accept this circumstance, despite the fact that it is not commonly accepted within the framework of a graduate training in Sweden; and on the other hand, the student is "frozen" in an incongruous stage. A final consequence of the long lasting graduation may be that experimental data may become obsolete and then difficult to publish or to include in the framework of a thesis.

One major dilemma detected at UNA refers to the gender disparity of students subscribed in the Ph.D. program (see annex 12.10.3., Table 3). Lea Velho has argued in her report (see section 9.1.) that sticking to only one training modality (e.g. "sandwich") is particularly difficult for females with children (this may be further aggravated for single mothers). The marked gender differences in MSc. and Ph.D. graduates at UNA are the result of many factors (e.g. differential selection, real opportunities for learning languages etc.), but the restricted training alternatives in turn may contribute to increase this difference.

Although important improvements in learning English language among the Ph.D. candidates are evident, the dominance of written and oral communication still represents a significant drawback for students performing training in Sweden (this was also expressed by the Swedish tutors). According to UNA authorities (stated in the workshops), this is particularly aggravated in the case of female candidates. In this respect the comments in Velho's report (see section 9.1.) are significant and must be considered as part of relevant problem that must be resolved in short term.

At first glance it seems satisfactory to train students in a large variety of fields as possible (see annex 12.10.5., Table 5). Although we may concur that this approach is important and relevant, mainly to assemble a pool of professors to teach undergraduate courses, it is weak in favoring the foundation of research groups. One of the major problems at UNA is the susceptibility of research projects and academic activities, due to the lack of repetition in training fields among the different investigators. That is, retirement of one investigator from the University may mean that the project would also be abandoned and the expertise lost due to the fact that no other person is trained to take over the project. Very likely, teaching at undergraduate and graduate levels will also suffer from this absence. Leadership, mainly carried out by well-trained personnel is even more susceptible, since in spite of their commitment, individuals are frequently tempted to perform other jobs or get involved in administration. As one Ph.D. female who recently graduated abroad (USA) expressed:

"At this stage we (at UNA) cannot pretend to be good in everything, we must concentrate our efforts and work together in a few research systems. In my discipline I am the only expert and there is nobody to talk with; in this sense I am scientifically isolated".

Following this, very few research teams were detected at UNA among academics holding a MSc. or Ph.D. degrees. Moreover, we were not able to detect collaborations among investigators involved in similar topics of research during their Ph.D. training. This supports our point of view regarding the increased susceptibility of research in UNA.

On the basis of the list of publications provided to us and extensive searches in ISI files (ISI, Philadelphia, USA, CD-ROM) very few submissions to peer reviewed international journals were detected among the UNA-SLU graduates. Even though, this fact does not constitute a strict measure of the advancement of science under the Nicaraguan circumstances; still it would be desirable to have more publications in well-known indexed periodicals. Moreover, publications in peer-reviewed journals are the framework on which achievements are measured by the scientific community (above degrees), and constitute the basis for justifying approval of research grants. Efforts should continue in this direction.

As stated above, having a local coordinator has been a very favorable decision, however, we anticipate several problems in assigning the coordination to a student enrolled in the collaboration. Although it is convenient to be acquainted with the bilateral collaboration between UNA and SLU, it is also necessary to have the academic and administrative rank and the necessary independence to take decisions and openly discuss with the Swedish counterpart, at the same level, the incoming vicissitudes of the collaboration. This is even more important when the Swedish counterpart exerts a very strong (and positive) leadership on the collaboration, as stated above. Under these circumstances, it is very unlikely that a local UNA coordinator enrolled as a Ph.D. student would have opportunities to exert an independent role, since we all know that the student-professor association is, with very rare exceptions, a vertical relationship. This dependence is even more evident and stronger at level of graduate training, as stated by one of the Swedish tutors:

“The Nicaraguan students are not colleagues in the same way as our Swedish Ph.D. students are not colleagues. They are students and the word itself implies that they are in a process of learning, from the supervisor or from other sources. Everybody that has supervisor experience knows that it is necessary with a certain distance between supervisor and student. You cannot be too close or too collegial if you want to be able to criticize the student. You would never criticize a colleague like that but in a supervisor/student situation it is your duty!”

Furthermore, by which means is the local coordinator going to coordinate the collaboration in Nicaragua while he is in Sweden performing studies? On which authority is he/her going to make judgments with respect to the performance of their colleague students? In conclusion we do not believe that this is an advantageous strategy, mainly when most of the students do not have a local tutor that can guide their research in Nicaragua (see above). Different alternatives must be found, mainly, when there are Ph.D. graduates that could be assigned to this duty under more favorable conditions.

9.2.2.3.3. Problems Associated to the Administration and to the Infrastructure. Currently, the bilateral collaboration subscribes to 17 international hard copy journals located at the central Library at UNA. Although this is a definitive achievement for promoting research and academic enterprises, no entire advantage of the on-line and CD-ROM information facilities are used. Dependence on hard copies, mainly books and journals, is a problem. CD-ROMs or Internet publications considerably reduce the transportation costs and facilitate the importation of books and journals due to the heavy weight and bureaucratic management at the customs office. Moreover, most journals arrive with delay (beyond 6 months). In this respect, some of the purchases may be “a waste”, since several of the journals acquired are already released freely after 6 months to one year of publication by the editorial companies (<http://www.library.unr.edu/ejournals/free.html>). It could be argued, that this problem is alleviated by the students having access to the SLU server; however, in real practice the Internet con-

nection is too slow. As pointed out by several investigators, Internet access is not very efficient, making it useless for several applications. In addition the reduced number of dedicated lines aggravates the problem. The major problem is the repairing and upgrading of the computer system, which must be replaced often. In this regard the Library system is also very sensitive.

Lack and deterioration of equipment is one of the specific drawbacks that hamper the day-to-day research activities in low-income countries [Thulstrup 1996]. A considerable support has been given to equip the Molecular Biology laboratory, to fix equipment and to purchase additional equipment as required (see annex 7.10.1., Table 1). Unfortunately, repairing of scientific equipment in Nicaragua is difficult and expensive. Under these circumstances, the absence of preventive measures to take care of equipment may work against the maintenance of functioning laboratories. Specific recommendations addressing this problem are given in the general report (see section 9.3.).

Problems in achieving efficiency in research come from several sources. However, one of the most significant obstacles comes from the tendency of well-trained investigators to procure administrative positions not directly related to research or teaching activities. Furthermore, the fact that some of these positions are attained during graduate studies complicates this perspective even more. In many cases the time spent in Nicaragua by the students enrolled in the bilateral program is to a large extent consumed on teaching and administrative work rather than in research activities towards her/his graduate training. It is of course not an easy task to combine the duties in a high ranking administrative positions and at the same time be committed to Ph.D. studies or scientific enterprises.

A very important problem signed out by all UNA instances was the absence of official recognition of research enterprises at the same level as the teaching and administrative activities. From all perspectives this position is less than detrimental for those institutions believing in science and promoting the benefits of this line of thought. The fact that academics cannot justify research time works against the consolidation of a research system and against the aspirations of performing sustainable science at UNA.

9.2.2.3.4. Problems Related to the Linking of Research with Society. Part of the objectives of the bilateral collaboration between UNA and SLU, concentrates on improvements to the Nicaraguan agroindustry (crop production, control of plagues, forestry etc), by establishing strategical alliances with stakeholders and organizations. With the exception of the given list of the National Institutions participating with UNA (see annex 12.10.6., Table 3), we were not able to find collaborations in the various documents or in the web pages we searched. Several of our investigations included the various enterprises supported by Sida, such as the National Union of Agriculture and Cattle-raisers, Forestry Development cooperatives as well as Rural Cooperatives. Moreover, several of the opinions and recommendations given by UNA personnel in the workshops pointed to deficiencies in linking research activities with agroindustry and with stakeholders. The general view was that the vinculum with public, popular and private sectors is still weak. Prof. Velho gives extensive comments in this direction in her report (see section 9.1.) that illustrates in part our concern.

We recognize that the academic thinking and research at UNA are partially isolated from their context, however, in contrast to Velho's insights (see section 9.1.), we believe that these activities have had a positive impact in society. Certainly, more effort is needed but the absence of resources and experience in establishing connections with the productive sector works against the UNA initiatives for establishing these stronger links with society. This is a very difficult and problematic issue, with no straightforward solution (see below).

9.2.2.4. Recommendations and Lessons Learned (UNA)

As stated, we are aware of the efforts that UNA and SLU have made to attack and resolve the various problems confronted during the collaboration. Several of our insights overlap with the recommendations put forward by UNA and SLU (see annex 12.10.4.), and may also overlap with the actions already taken by these two Universities and by Sida/SAREC. Our recommendations, in addition to the statement (e.g. "to get literature"), also include specific actions for solving some of these problems. As expected, the recommendations and lessons learned presented here are connected to the same main subjects indicated in the previous section, that is, sustainability, academic matters, administration and infrastructure and relationships with stakeholders and society.

One of the most difficult issues to built research capabilities concerns to the promotion of sustainability. In agreement with what Sida/SAREC has supported during the last 16 years, we believe that the most urgent factor has been the education of UNA academics in science. Without this prerequisite, thinking in sustainability is just a wasted dream. Is precisely for this reason that the educational process (Ph.D. training) must continue, and even extended, according to the plans indicated in the various UNA-SLU reports handle to Sida/SAREC [UNA 2000].

It is important to understand that holding a Ph.D. degree does not necessarily prepare for being an independent scientist, capable of writing her/his own papers, making proposals and elaborating reports. Moreover, a Ph.D. degree does not automatically qualify for being a tutor for graduate students or give the necessary skills for fund-raising and administration of research funds. In other scientific environments these activities are commonly learned during postdoctoral training, and pulled out from a broad research-based environment. However at UNA these circumstances do not exist at the present time. Nevertheless, to be aquatinted in all these activities is even more important in low-income countries, such as Nicaragua, in which national research funds and administration for research are practically nonexistent. In this case, the investigator must be trained to perform many activities. We recognize that some of these handicaps may be idiosyncratic for Nicaragua, but others seem to reflect the dynamics of the training programs. Whatever is the case, the important issue is to comprehend that Nicaraguan graduates require more than just specific scientific knowledge to be successful in a very aggressive and painful environment for performing science, as is commonly the case in low income countries. This is a very difficult task that must be effectively attacked if long-lasting research capacity is envisioned in Nicaragua.

During their training, students should be subjected to writing grants, to the administration of small funds and to fund-raising strategies. Several of these activities can be learned in Sweden, but others are more suitable to be learned in Latin America, under the supervision of groups that know very well the problems that low-income countries confront in research development. Practical and goal-directed exercises for writing small grants (e.g. IFS or TWAS) and for discussions on the administration of research can be carried out in Nicaragua with the supervision of Swedish and Latin American scientists. These exercises should include administrators, supporting personnel and students, in order for them to become familiar with the process, and hopefully should conclude with a submission of research proposals.

Identification of comparative advantages is another exercise that greatly contributes to obtain funds and scientific competitiveness in low-income countries such as Nicaragua. Comparative advantages are unique or rare circumstances existing in a country that are used to initiate collaborations and fund-raising enterprises (e.g. study of snake venom toxins in Brazil). For a trained mind, even unfortunate circumstances such as the high prevalence of infectious diseases, or the appearance of epidemics, may be turned into comparative advantages for research purposes and for fund-raising. Commonly, comparative advantages are found in conjunction with stakeholders and by analytic exercises that

accommodate research interests with the priorities established by fund raising agencies (e.g. conservation of biodiversity in relation to drug production supported by pharmaceutical companies). Once comparative advantages have been identified, they should be used strategically in order to maintain control over them (e.g. control the census, identification of germoplasm from valuable trees in a national reserve). One of the major benefits of having control over comparative advantages is that facilitates original research and does not necessarily depend on complex technology. Moreover, comparative advantages are in many cases appealing and interesting topics for laboratories abroad, and in this respect, valuable for establishing collaborations that may allow more sophisticated technical enterprises.

English language is nowadays the language of science. Precisely for this, practicing English language should be permanently maintained beyond MSc. and Ph.D. training. In order to become independent scientists, Ph.D. graduates must constantly improve their skills by writing scientific papers and publishing as much as possible in peer-reviewed journals in English language. This is not an easy task and requires much effort. In this sense, it is very important to maintain the collaboration with Sweden and to establish new collaborations with high-quality research groups that could help to teach and improve these skills. These collaborations will strengthen research in Nicaragua and will help to build scientific careers based in publications that later could be used to demonstrate qualifications to granting agencies. In addition, it is also necessary that Nicaraguans diversify their collaborations and founding sources. In this regard, the already planned training activities in third countries should also serve to establish the necessary links for future collaborations and joint research ventures. During our study we were not able to find collaborations of this kind.

In a country such as Nicaragua, a single committed and well prepared scientist with good command of the English language, capable of writing papers, able to identify comparative advantages, possessing skills in fund raising and proficient in establishing collaborations, is priceless. To graduate MSc. and Ph.Ds with good technical and scientific knowledge is good and necessary, but to have independent scientists must be the final task. For this reason it is also important to maintain and expand the collaboration with Sweden and with other countries beyond the Ph.D. level. One scientist of this kind makes the difference; two are a remarkable accomplishment.

Historically, the public Universities in Nicaragua have been seen as institutions where everything is free, and where research activities and economical enterprises are divorced ventures that could not be joined. In Latin America, this picture has changed and a different alternative has been observed in the last 20 years. Nowadays, a considerable number of successful research groups and institutes are involved in economical-research based enterprises that partially support investigative activities and serve to improve the research conditions, including the salaries of the investigators and technicians [Fundación UNA 2000; <http://www.ucr.ac.cr/~fundevi/>]. In this respect, it is also important for UNA investigators to participate in this kind of ventures in order to capture funds for research reinvestment. This does not mean that everybody has to be involved in economical research-based enterprises. If properly done, and under suitable supervision and adequate ethical codes, these economical research-based activities are compatible with teaching as well as with more fundamental research. Moreover, these ventures may be also important to link stakeholders and society with researchers, and serve as a feedback for scientific and academic activities. For instance selling diagnostic services of infectious disease of plants and animals (e.g. PCR of plant and avian viruses), genetic analysis in forestry, consultancy in agroindustry, soil analysis etc., constitute common practices that bring research, economical ventures and society, together. Many examples of these joint ventures are found in Latin America and Sweden [IVA/VINNOVA 2002].

As stated before, scientists cannot live on scientific merits alone, and they require additional incentives. We already suggested that economical activities of research-based enterprises might partially resolve the economical difficulties of investigators. Fund raising activities may solve the problem of fellowships for graduate students and per diems for technicians and investigators. In addition, sabbaticals and assistance to congresses supported by UNA may constitute other incentives beside salaries. However for these activities to flourish, scientific research urgently requires to be recognized as an official enterprise, at the same level that administration and teaching activities are recognized at UNA. The good intentions demonstrated by the administrators of UNA, require to be transformed into concrete actions. Recognizing research as an official activity is a political decision. From the philosophical point of view there are no reasons to maintain this position highly detrimental for scientists. It is urgent that UNA authorities, in conjunction with Faculties, Departments and scientific groups reach the adequate consensus to resolve this important matter. A contingency plan is required and Sida/SAREC may help in this process.

No perfect training model has been developed yet. No doubt that the "sandwich" modality has been a very important alternative, which virtues have been recognized elsewhere [Hogstedt, et la. 2001]. However, it is also detrimental to stick to one model only, when other alternatives may also function, according to the circumstances. In this direction, we strongly recommend to move from the open-sandwich model to the closed modality. Certainly, we understand that a pool of tutors holding a Ph.D. is necessary. UNA already has several Ph.Ds, two of them educated in SLU and three others trained in third countries (see annex 12.10.2. Table 2). Although reduced, members of this group of Ph.Ds could serve as tutors for those students enrolled at SLU graduate program. In case some of the students do not find a qualified tutor in UNA, he/she should try to find a qualified person outside the University (e.g. Industry or Ministry of Agriculture) or even in other Central American countries. The closed-sandwich model, even with tutors outside the scope of the local University, has proven to be much more efficient than the open modality without a local (regional) tutor [Nieto 1996 <http://www.netropica.org>]. In some cases a model based in triangulation may serve as a relevant alternative. In this model, SLU and UNA shall work together (through a Ph.D. student) with a third research unit outside Nicaragua (e.g. Honduras, Costa Rica etc.). This triangulation is even more necessary when the required expertise is not found at SLU, or a local tutor is not found in Nicaragua. Triangulation within the region has several advantages, linked to the collaboration and future joint educational ventures among the various Central American countries. In other cases, the classical model could serve good purposes. That is, the student simply could expend all his/her training time in Sweden enrolled as a typical foreign graduate student. Although, in some cases this alternative may present disadvantages (e.g. brain drain) it also has strong virtues (e.g. student is able to concentrate full time in research and learn more from a foreign country and well developed laboratory). In this regard, Dr. Velho has made a strong case that may explain the differences found in gender among the Ph.D. students elsewhere in the Nicaraguan Universities enrolled in the "sandwich" modality (see section 9.1.). Moreover, other training models have also been successful in Central America and used for decades (for a clear example see the training model followed by Germany in Central America, <http://www.daad.de>). Here we have proposed various models for Ph.D. training, but we are sure that SLU and UNA academics would envision other alternatives that would avoid the justify worries of a SLU professor:

"..to send students to other countries for Swedish money without getting anything back and without knowing anything about what kind of education they are getting is not an attractive or interesting alternative for me personally and I am sure that the Swedish taxpayers would think the same!"

Strictly, we do not believe that any one model is better than other models, they are just different. In this sense, we do not favor a particular model over other, we favor diversity of opportunities. Then, the

different models could be selected for each student (and tutor) according to his/her needs, requirements and personal circumstances, and consequently, not adjusting the students (and tutors) to a unique alternative. Single alternatives are understandable at undergraduate level, but at graduate level more flexibility in training models could be observed.

Ph.D. UNA candidates should accomplish several requirements before acceptance to the program, independently from the training model. Besides the minimal academic qualifications, candidates must demonstrate an adequate command of the English language. For this, international tests (e.g. TOEFEL, Michigan and British Council tests) that have served for decades to evaluate the appropriate level of English understanding to perform graduate studies abroad should be used as reference for accepting students. There is no justification why these standard tests, performed in almost every single country, are not used. This approach constitutes an objective manner to evaluate English proficiency and clear rules for both parties.

Another very important requirement refers to the time devoted for research. Enrolled Ph.D. students should devote at least part time of their working period to research activities related to their training, without involvement in administrative positions or extensive teaching obligations while in Nicaragua. In order to make this official, we suggest to make an agreement letter signed by the student, SLU and UNA. The student and the tutor(s) should acquire an optimal level of compromise. It is simply not acceptable that a student gets involved in administration or the University assigns full time teaching to a Ph.D. student involved in a Sandwich program. UNA should make a clear compromise and give time to the enrolled Ph.D. students to perform research while in Nicaragua. In the same direction it is not convenient for the tutor(s) to tolerate this circumstance. Research objectives must be accomplished also in Nicaragua; otherwise it is not a sandwich training model but just a part time training activity performed in Sweden. In this sense an authority with the adequate rank (hopefully a tutor) should be responsible for the surveillance of the training period in Nicaragua. The relevance of this point is discussed below.

We have argued that a long-term collaboration between UNA and SLU requires at least two coordinators; one Nicaraguan and one Swedish, with enough academic and administrative ranks to coordinate at the same level the activities between the two Universities. This shared responsibility has demonstrated to be even more successful in "sandwich" oriented training models [Nieto 1996]. Monitoring systems implemented by a local coordinator are also more efficient. The local coordinator, in addition to possess the adequate academic and administrative rank, should accomplish the following requirements: to have an extensive command of the English language, be well versed on the bilateral program, be acquainted in scientific subjects, have extensive access to internet, facsimile and phone, be assigned at least 10 h weekly and have a part time secretary. Local coordinators in UNA may be selected from the pool of Ph.D. students already graduated.

As stated before, during our survey at UNA, we detected several enthusiastic academics and investigators, but very few research teams studying in a coordinated manner a single scientific problem. Prof. Lea Velho also detected this circumstance by looking in detail the grant applications submitted to the Research Council (see section 9.1.). Is therefore relevant for UNA to built research groups under the leadership of the most experienced investigators. It is also recommended that training of future PhDs continue to be carried out in close-related areas as seems to be the case at the present time. This repetition in training fields will increase the chances to concentrate efforts and become strong in a few well-defined areas. It would be convenient to elaborate a plan by UNA and SLU in this direction. In the absence of a critical mass, it is better to concentrate in a few research fields than to dilute in many different enterprises.

As stated before, one of the main concerns of UNA refers to the impact of research activities in the Nicaraguan society. However, there are no identifiable functional and concerted systems in Nicaragua that could serve as facilitator for establishing links between UNA research activities and society. For this reason the initiative must come from the UNA investigators. Links between UNA research activities and stakeholders, producers, and agroindustry is a slow and delicate process that requires a concerted effort from many actors. One alternative is to organize workshops by sector, involving the whole range of stakeholders in order to create a common language and foster linkages. Opening basic courses and problem-oriented talks directed to specific social groups, in which scientific achievements are demonstrated in simple and comprehensible form for all stakeholders is the first step. Initiate regular joint publications in the form of brochures and small pamphlets accessible for all, even for those with very low educational level. UNA through its extension programs should develop their own projects for linking research results with society. However, for this is also important to collaborate with the other Nicaraguan Universities in order to incorporate other groups, such as Anthropologists, Engineers, Teachers, Nurses, Medical Doctors, Epidemiologist and Social Workers. It is also important to use these ventures to improve research activities. This should be seen as a feedback process. Excellent examples of how to perform these enterprises are found in Central America and in Latin America [<http://www.icp.ucr.ac.cr>; Fundación UNA 2000; Niemeyer, 1997; Texeira and Benchimol 1993].

One final remark concerns to the difficulties of promoting interactions between UNA and different social actors (see annex 12.12.). As stated above, it is true that the integral solution of problems requires the participation of many actors. However it is also important to understand that these actors cannot be artificially joined by a magic procedure. Most of the time, they come together by genuine common interests and very frequently by the initiative of one of the parties. In the absence of committed groups of excellence it is very difficult to initiate constructive dialogues between academics and other social groups in Nicaragua. That is, artificially joining several actors in the same arena produce nothing if these actors do not have the tools to generate ideas and resolve specific problems based in reality. Without involvement of well-educated scientist the different actors could do very little, because they do not know what conditions caused the problem and how to approach the various circumstances.

Among these actors, universities are a priority, and increasing the quality of individuals and groups is mandatory. In this regard UNA scientists trained in SLU have pursued real important problems related to agriculture and forestry. The role of the facilitators such as Sida/SAREC is to support the groups as much as possible and let them establish their links, according to their rules. However we must keep in mind that links by themselves are not that important. What really matters is the quality of those links. The first priority is to favor the training of groups of excellence at UNA. In this sense, the bilateral collaboration has strong and definitive merits. For this reason we believe that Sida/SAREC should maintain UNA-SLU collaboration for a protracted period of time until more mature and experienced scientific groups are generated. Once this prerequisite is accomplished, the relations with stakeholders will flourish, as consequence of the intrinsic dynamism of investigators committed with their country. Part of the difficulties in understanding this process is because to built groups of excellence requires time. In Nicaragua this is a chronic and recurrent problem that must be solved by a combination of patience, commitment and excellence.

We do not believe that a “national system of innovation could be made up of actors which are not particularly strong” (see annex 12.12.). Unfortunately this is what has been happening in Nicaragua for decades in agriculture and in other productive systems. Actors have been talking for decades with very littler solutions to practical problems. Enthusiasm is important but not sufficient. In this sense, at least one strong prepared group is necessary for leading the joint efforts towards a clear direction. Certainly it is not sufficient to make a research system strong, if it has no links with other parts of the system. Fortunately, strong groups with weak links constitute rare phenomena. Commonly, groups of excellence

naturally generate strong links with society. In conclusion, procure to proportionate the intellectual tools to “socialize” in a constructive and positive manner. However should be avoided trying to built a “common language” were most of the actors are not listening, because they do not have the adequate training or interest, or worst, because nobody is able to give practical and definitive solutions to known problems (e.g. the diagnosis of infectious disease in crops). Precisely, is for this reason that the priority has been to generate these (scientific) groups of excellence that could generate positive changes in the agriculture and forestry of Nicaragua. We strongly support this strategy above other alternatives.

10. UNI evaluation report

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10.1. Summary

The Swedish International Development Cooperation Agency (Sida) has supported research capacity building in Nicaragua for 20 years. Four public universities in Nicaragua and five in Sweden take part in a collaboration that targets four areas: health, natural resources and agriculture, engineering, and environment. Sida is the main foreign donor to research capacity building in Nicaragua. The budget of the present three-year period 2001-2003 is 82 million SEK (approximately 8.2 million USD).

The Department of Research Cooperation (SAREC) at Sida commissioned in May 2001 an evaluation of the research collaboration with Nicaragua. The general objective was to give guidance on the future direction of the cooperation and means for its implementation with the purpose to make it more sustainable and efficient. This report refers specifically to the cooperation with the technical university - Universidad Nacional de Ingeniería (UNI). General conclusions and recommendations of the evaluation can be found in the main document: “Evaluation of the Future Direction of Research Cooperation between Nicaragua and Sweden”.

The Sida support to UNI (4,6 million SEK, 2001) is directed mainly to research capacity building at the Faculties of Chemical Engineering, and Electrical and Computer Engineering. Support is also provided to improve university administration, strengthen the research council, and to information technology (ICT) infrastructure. The general objective of the cooperation is “to strengthen research capacity in Engineering Sciences in strategic areas. Focus is made on research training towards PhD with an intermediate degree (MSc/Licentiate)”. The long-term objective is “to create a sound and viable research environment with competent researchers that independently can carry out research of good quality relevant to the Nicaraguan society, and to provide the country with analytical capability to analyse its own development problems”. The research training is based on the “Sandwich model”. Three to six months per year are spent at the Swedish counterpart university for courses and supervision. In Nicaragua, the student combines the regular tasks as teacher with research activities.

UNI is the largest technical university in the country. It is one of ten universities that benefit of government funds for higher education. The first students in the research training programme at the Faculty of Chemical Engineering started in 1986. Swedish counterpart is the Department of Chemical Engineering at the Royal Institute of Technology (KTH), Stockholm. Today ten students are studying for PhD, TkL, or MSc degree in one of three components: drying, process engineering, and waste water treatment. Six TkL thesis have been produced so far. The programme at the Faculty of Electrical and Computing Engineering began in 1991 in the areas of industrial control systems and data communication. A third component, Applied Electronics was added in 1998. Swedish counterparts are

the Department of Industrial Control Systems, KTH, and the Department of Applied Electronics at Lund Institute of Technology (LTH). Of the five students one has obtained a TkL degree. Through the experience gained in the research programme, the team have been able to carry out qualified consultancies to the industrial sector.

In spite of the poor outcome in academic degrees, the cooperation has advanced according to the objectives. The Research Council, the Strategic Plan, and the progress of the ICT project are important steps towards improved research policy and research environment. Few but well established contacts have been made with the productive sector. The research programmes have had an impact on the quality of the under-/graduate education. The research areas are relevant for the development of the Nicaraguan society. Provided that research activities is given due priority, both programmes should be able to produce PhD's within the next one or two years.

On the other hand there are issues of concern that may reverse the achievements made: (i) Critical mass of research capacity - at least one PhD is needed in each research group; (ii) Slow progress – not enough priority given to research in relation to other tasks, (iii) Poor planning of the individual research project; (iv) Ability of the university to keep skilled staff; (v) The electoral system at faculty and university level does not promote long-term stability; and (vi) The dependency on Sida support and Swedish counterparts to maintain research activities. These problems are not specifically related to the Sandwich model as such. They rather reveal weaknesses in planning of the research projects, in the administration of the cooperation at UNI and to some extent at the Swedish counterparts.

Recommendations to the Chemical Engineering Programme:

Though progress has been slow there is a dedicated and qualified team that in a few years time should be able to continue research with less support from Sida. Within the present period 2001-2003 three students are expected to complete the PhD, two TkL and three the MSc degree. This capacity will prove a sound basis to carry out research more independently in the future.

It is therefore recommended to prepare to phase out the support to the projects in process engineering and drying. This should preferably be made in a step-wise approach, to ensure that enough time is given for research groups to adjust to the new conditions. Further it is recommended that the project in waste and drinking water treatment should be transferred to CIEMA - the new environmental centre at UNI.

The rather poor conditions of the research laboratory facilities calls for a strategy for development and maintenance on short- and long-term basis. Given the time spent and the capacity developed in the programme, the collaboration would gain if the relation to the Swedish counterpart became more symmetric. A dialog on how to widen the existing research contacts within KTH would probably prove beneficial for both parties.

Recommendations to the Electrical and Computing Engineering Programme:

The fields of research are relevant, but from research capacity point of view, the team is relatively small and therefore vulnerable to changes. The probability to maintain a critical mass of research capacity should improve if the programme had at least two students in each area.

It is therefore recommended to look into the possibilities to extend the programme with two or three students. Before decision on extension are being made, issues regarding sustainability of the programme need to be addressed. Particularly how to maintain a critical mass of researchers, and to improve efficiency of the individual research projects.

The perception of the evaluation is that in the past there have been conceptual discrepancies on the cooperation between SAREC, the Nicaraguan counterparts and the Swedish supervisors. Though less accentuated today, it is important to stress the need for a shared view on the role of research capacity development as part of a wider knowledge system.

10.2. Introduction

The Swedish support to public universities in Nicaragua has a long tradition. Since the first individual research project in 1981, targeted to solve specific problems in the agricultural sector, the support has developed through several stages. In 1986, the first PhD training programme began in cooperation between universities in Sweden and Nicaragua. Today, the aim to foster research capacity is combined with a holistic view on the role of research in society and the need to strengthening universities as part of a wider knowledge system. The Department of Research Cooperation (SAREC)¹ at the Swedish Development Authority (Sida) supervises and provides the financial support for the cooperation. Sida is the main foreign donor to research capacity building in Nicaragua. The total budget for the cooperation of the present three-year period is 82 million Swedish Crowns (SEK)², distributed as 22 M SEK/2001, 30 M SEK/2002, and 30 M SEK/2003.

The Sida/SAREC research training is based on the so-called “Sandwich model”. In a “sandwich programme” three to six months per year are spent at the Swedish counterpart university to attend courses, receive supervision and carry out selected research activities. At the “home university”, the PhD student maintains the employment and combines the regular tasks as teacher (part-time) with research activities. In fact, the main part of the research should be carried out at the “home university”. This study model was partly developed as a means to avoid so-called “brain drain” from Universities in the South through the continuous contact with the home institution. The model is also a means to identify and carry out research relevant to Nicaragua.

Four Nicaraguan and five Swedish universities take part in the cooperation. The two large national universities: Universidad Autónoma de Nicaragua en Managua (UNAN-Managua), Universidad Autónoma de Nicaragua en León (UNAN-León); and the two agriculture and engineering sector universities: Universidad Nacional Agraria (UNA) and Universidad Nacional de Ingeniería (UNI). The Swedish counterparts are: The Swedish University of Agricultural Sciences in Uppsala, The Karolinska Institute, The Royal Institute of Technology (KTH), The Lund University/ Lund Institute of Technology (LTH), and the University of Umeå. The Research programmes are focused to four areas: health, natural resources and agriculture, engineering and environment. In addition support is provided to the National Council for Universities (CNU) for joint activities promoting the reformation of the university system.

The present report refers specifically to the evaluation of the Sida support to the National University of Engineering – Universidad Nacional de Ingeniería (UNI). The report is part of the evaluation of the research cooperation between Nicaragua and Sweden commissioned by Sida/SAREC in May 2001. As stated in the Terms of Reference¹, the overarching objective of the evaluation is “to give guidance on the future direction of the research cooperation and means for its implementation with the purpose to make the cooperation more sustainable and efficient”. Hence, though the history of the different projects has been reviewed, focus is made on the aspects of the cooperation that can be improved for the future, rather than detailed measurements of the past.

Individual evaluation reports have also been prepared for each of the other three Nicaraguan universities that take part in the cooperation. Many topics raised in the present report are in common

¹ Sarec, formerly a separate governmental organisation was incorporated into Sida in 1995

² 1 USD is equivalent to approximately 10 SEK (April 2002)

with the findings for the other universities, and may therefore have been repeated in one of the other individual reports. For the general findings, conclusions and recommendations, the reader is referred to the main document: “Evaluation of the Future Direction of Research Cooperation between Nicaragua and Sweden”.

Besides the present evaluation of the research cooperation, Sida has commissioned a study of the system for higher education in Nicaragua (Tünnerman et al, 2002). The Sida research cooperation with UNI has been evaluated at a previous occasion (Lieberknecht, 1994).

10.3. Programme Context

The following refers mainly to the Sida/SAREC cooperation with UNI. A more general presentation of the programme context can be found in the main document of the evaluation.

10.3.1. The National University of Engineering (UNI)

UNI has approximately 7,500 students and 1,200 members of staff distributed between six faculties in two campus areas: Faculty of Industrial Engineering, Science and Systems, Civil Engineering, Architecture, Chemical Engineering, and Electrical and Computer Engineering. Besides, UNI has established centres for masters programme, laboratory services and consultancy services as: the Urban and Landscape Environment Studies Programme (PEA-UT), the Environmental Engineering Programme (PIDMA), the Technosoluciones consultancy service, and the Biomass project (Biomasa)¹. A new centre for environmental research – CIEMA is currently being established². UNI has also started a “private” university within the main campus, where BSc education is offered to students who can afford to pay for their studies.

The Sida/SAREC research programme support has mainly targeted two faculties: Electrical and Computer Engineering, and Chemical Engineering. The two faculties are briefly described below (2.1.1 and 2.1.2).

10.3.1.1. Brief historical background

UNI was established in 1983, as an attempt to concentrate resources in engineering training in the country. In consequence, the two existing engineering schools at UCA and UNAN-Managua were merged into the new institution. The economic context was maybe not the most favourable, and there were many factors that influenced progress of the university. Though it might seem as part of the history, it is worthwhile to have these initial conditions in mind when assessing the progress of the research capacity building.

Following the overturn of the Somoza dictatorship in 1979, the 1980s was characterized by dramatic change for the Nicaraguan society. The economic instability, aggravated by cold war politics, led to a considerable brain drain and many university lectures left the university or the country. At the same time the government four folded the number of university students. As there were not enough qualified teachers, the increase in number was made on the expense of the quality of the academic training. Often the senior students were obliged to train the newcomers. To this should be added the poor condition of infrastructure, with shortage of lecture halls and practically non-existent laboratory facilities. On the other hand during the 1980s, UNI as many other Nicaraguan universities encouraged

¹ Biomasa was previously part of the Department for Research and Technology (DINOT), that carried out applied environmental research activities with financial support by Austria. However the DINOT disappeared once the external support ended, and Biomasa manage to remain active as water quality laboratory.

² UNI has applied for Sida/Sarec support for the new centre. A separate feasibility study has been done on this proposal (Alveteg, 2001)

teachers and students to relate closer to the immediate needs of society. Many interesting applied research projects were initiated in collaboration with NGO:s, cooperatives, and government owned companies.

Historically the role of the universities in Nicaragua as in many other Latin American countries was at first hand to produce the professionals needed for public administration and to some extent for the private sector. Research and research capacity building were not prioritised. Therefore, when research cooperation began, it was not only a matter of launching individual research projects, but also about to foster a culture of research and to change the perception of the role of university in society.

UNI is one of the ten universities that receive government funds for higher education. Since 1990, the amount is set by law to 6% of the national budget. Though a source of violent conflicts between the government and the university students at several occasions, this has meant a relatively stable source of income. In 1999 the amount allocated this way to the four public universities was 420 million Córdobas (approximately 30 million USD).

Over the last years the number of higher education centres in Nicaragua mushroomed to more than 30, including both public and private institutions. – A relatively large number considering the size and population of the country. Of the private centres that offer technical education to BSc level, the UPOLI (Universidad Politécnica) is maybe the most important. UNI however, has maintained its reputation and is still the largest technical university. It is also the only one with research programmes. In fact many of the private centres are depending on UNI staff contracted on part-time basis to give lectures or to conduct complete courses. This is an important additional source of income for many of the qualified teachers at UNI.

In 1998, UNI started an ambitious process to improve quality both of education, research as well as the university administration. A strategic plan was adopted (UNI, 1998) with short-term and long-term goals to modernize the university. The document stresses among other things, the importance of research, and how educational programmes should benefit qualitatively from the research carried out at the university. The process contemplates the strengthening of the Scientific Council of the university. As part of the implementation of the strategy, the Scientific Council has outlined a research agenda (UNI, 2001c). UNI is also working on an accreditation programme on a Central American level for their Masters programmes and for the laboratories.

The strategy also considers improved links with the private sector as vital for university development. The Chamber of Industry and Commerce of Nicaragua (CADIN) presented in February 2001 a policy document that discusses the potential benefits of a closer cooperation with universities. Particularly in the area of applied research (CADIN, 2001). The present Director of Research at UNI, who also is a member of the SAREC research cooperation, took part in the preparation of the document.

10.3.1.2. Faculty of Chemical Engineering

The school of Chemical Engineering was established in 1983, and in 1990 renamed as Faculty. The faculty has about 580 active students and 36 teachers on full-time or part-time basis. Education is offered up to BSc level. There are plans to start a Masters programme in Chemical Engineering. The Faculty is equipped with seven laboratories: Drying; Food Analysis; Physical-Chemical Water Analysis; General Chemistry; Microbiology and Bacteriology; Biotechnology and Crystallization.

Besides the Sida cooperation the faculty have had support from The Netherlands. The Dutch support (NUFFIC) continued for 10 years up to 1997, and was channelled through TU Delft. The programme was shared between the Faculties of Chemical Engineering, Civil Engineering, and PIDMA. It referred mainly to MSc training in wastewater treatment (in the Netherlands), support to laboratory facilities

(equipment, training and maintenance), and applied research work in Nicaragua. During four years teachers/lectures from TU Delft were also stationed at UNI. Other sources of training of faculty staff have been provided by Germany, Colombia, Costa Rica, Mexico and USA among others.

10.3.1.3. Faculty of Electrical and Computing Engineering

The education in electrical, electronic and computer engineering at UNI began in 1985. First as three different schools, and by 1990 they merged into one faculty. The faculty is the largest at the university with approximately 2,500 active students, 34 full time graduate teachers, 30 assistants and 20 part-time teachers. At present the education offered is on the undergraduate level (BSc), though there are plans to launch a master programme in electrical engineering/industrial control systems. The faculty's training and research laboratories are relatively well equipped, though there is a general need for more localities.

The faculty has also created a semi-independent organisation called "Technosoluciones". It carries out consultancy services to the private and public sector, and so provides an opportunity for additional income for the affiliated teachers/researchers. The Technosoluciones is part of a strategy to create incentives for skilled staff to remain with the university once they have finished their MSc/PhD degree. As there is a lot of demand for qualified consultancies in computer and system analysis, Technosoluciones has been a successful enterprise.

From 1985 through 1995, the faculty received substantial support from The Delft Technical University (TU Delft) in the Netherlands¹ (Plazaola, 2001). The support was provided in three consecutive phases: (i) Construction, equipment and maintenance support of laboratories for undergraduate² courses in electrical and electronic engineering; (ii) short (6 months) training visits to TU Delft for faculty staff, and complementary laboratory equipment; (iii) support to upgrade teaching staff at the faculty to MSc level, and support to industrial liaison activities through thesis work and problem solving of needs in the industrial sector. The MSc training in phase (iii) consisted of 1 to 2 years abroad in the UK or Brazil. During 1983-1990, the programme also supported the undergraduate programme with university teachers from Cuba³. The faculty has also received support through short training visits to universities in Germany⁴, and opportunities to access postgraduate education in USA⁵. The SAREC programme at the faculty began in 1991 (see chapter 2.2).

10.3.2. Sida/SAREC Research Cooperation

The first Sida/SAREC cooperation programme at UNI was signed in May 1985. The following year the first three students from the Faculty of Chemical Engineering began their training in the fields of Drying and Crystallisation at the Dept of Chemical Engineering at the Royal Institute of Technology (KTH), Stockholm. These students were still working on their diploma degree, and therefore according to the Swedish supervisor, the actual PhD students programme did not began until 1987. One interesting point is that the initiative to this programme came from students at the two universities. A new field - Environmental Engineering - was opened in 2001. In a first stage as part of the Chemical Engineering programme, with perspectives to later merge with the new environmental research centre - CIEMA.

The second programme started in 1991 at the Faculty of Electrical and Computer Engineering. Counterparts are Dept of Industrial Control Systems, and the Radio Communication group at KTH,

¹ The Support was provided by the Netherlands University Foundation for International Cooperation (NUFFIC), through the Delft University of Technology (TU Delft).

² In this text, undergraduate refers to courses up to BSc, and graduate courses up to the MSc level

³ Universidad de Las Villas; Instituto Politécnico de la Habana; Instituto Politécnico del Oriente

⁴ Through Deutscher Akademischer Austauschdienst (DAAD)

⁵ Through the LASPAU and FULBRIGHT programmes

and the Dept. of Applied Electronics at the Lund Institute of Technology (LTH). In recognition of the fact that building research capacity takes time, the cooperation has opted for a long-term commitment to strengthen research at the selected faculties as vital part of a comprehensive knowledge system. The objectives and design of the research cooperation has developed over time. The first years, focus was mainly on the individual PhD student projects. Today the research capacity building from Sida's point of view is clearly seen as a part of a wider system, from the faculty, to the university and its relation to private and public sector society.

10.3.2.1. Capacity objectives of the cooperation

The main objective⁶ of the cooperation is to strengthen research and research capacity in Engineering Sciences at the National University of Engineering (UNI) in strategic areas. Focus is made on research training towards PhD with an intermediate degree (MSc/Licentiate). The long-term objective is to create a sound and viable research environment with competent researchers that independently can carry out research of good quality relevant to the Nicaraguan society, and to provide Nicaragua with analytical capability to be able to analyse its own development problems. The participating faculties should be able to take active part in international cooperation and be able to adapt and optimise technological transfer to the country. The researchers should create good links and relationships between the university and the productive sector. The researchers will contribute to an increased quality of the undergraduate and graduate education offered by the university.

10.3.2.2. Present cooperation

The main part of the funds is directed to the research capacity building programmes at the faculties of Chemical Engineering, and Electrical and Computer Engineering. During 2001 funds will be allocated to support the preparations of Masters programme at both faculties. Support is also given to improve efficiency of the university administration, and to the Research Council. The total amount of the cooperation for 2001 was 4,6 million SEK (see table 1). The amount for the following two years is expected to increase to 5,5 million SEK per year. On a separate budget, UNI has also received funds for an ICT project, to improve internet communications and on-line library services at the University.

⁶ Excerpts from Sida/Sarec programme document "Insatspromemoria 2001-2003"

Table 1: SAREC's financial support to the programme at UNI

Sida support to UNI, 2001	SEK x 1000
Institutional support:	
Scientific Council	300
Administrative Development – University Management	200
Faculty of Electrical and Computing Engineering:	
Industrial Control Systems	635
Data Communication	570
Applied Electronics	345
Development of a MSc programme in Electrical Eng.	200
Faculty of Chemical Engineering:	
Drying	785
Process Engineering	815
Environmental Engineering	550
Development of a MSc programme in Chemical Eng.	200
Total:	4 600

10.3.2.3. Institutional Support

As a means to contribute to the reform process of the university, funds are provided to administrative development. Funds should be used for staff development, development of a research strategy of the university and activities leading to a better quality of the university system.

In order to stimulate research capacity building activities at the university in general, funds are provided to a research fund. Grants should be provided upon application and approved by the Research Council. The research funds are used for small research grants, recruitment of young researchers, participation/arrangement of conferences/workshops, dissemination of results.

10.3.2.4. Chemical Engineering Programme

The SAREC cooperation with the Faculty of Chemical Engineering began as mentioned previously with the signing of a cooperation agreement in May, 1985, while the actual research cooperation commenced in January 1986. At the time, the agro-industrial sector, especially the sugar and coffee industry in Nicaragua was in need of improved technologies. Another area of priority was to improve storage of cereals and beans in order to reduce losses after harvesting. In response to these needs, crystallization and drying was selected as research areas. As mentioned previously, the university infrastructure was in poor condition. Therefore, the first years of cooperation gave priority to laboratory development, purchase of equipment, and training in the use of maintenance of laboratories. Then, the first two students (Drying) obtained their Licentiate (TkL) degree in 1992, and the third student (Drying) in 1993. And the two students from the Crystallisation area obtained there TkL degress in 1995 and 1996 respectively.

In 1994 a new Dean of Faculty was elected. The new administration had a very hostile approach to research and five of the SAREC students left the programme. Nevertheless, due to the constructive support by the Swedish supervisor, Dr Joaquin Martinez, they completed the TkL degree before leaving

UNI. Two of the students continued outside the Sida/SAREC programme as students at KTH. The other three got qualified employment in the private sector. In the next faculty elections (1998) the conjuncture changed more in favour of research activities, and the SAREC programme was built up again. In 1997, the Crystallization research area was closed. The decision was taken when the two students (after finishing the TkL degree) decided to leave university for work within the private sector. In 1989 a research area in process engineering was opened, and finally in 2001 was the Waste and Drinking Water Treatment area added.

In 1998 the cooperation was extended to give the opportunity to carry out part of the studies up to the MSc level in Spanish at the National University of Chile. The objective behind this was two-fold: to facilitate for new research contacts and networking within the Latin American continent, but also to shorten the time to obtain a Masters degree.

At present there are ten students involved for PhD, TkL, or MSc level in the SAREC programme. Besides, there are four teachers studying to obtain a degree outside the SAREC programme (2 MSc, 1 PhD and 1 BSc).

Table 2: Student involved in the Sida/Sarec research-training programme in Chemical Engineering, June 2001:

Student	Degree	Starting year	Expected year of completion	University, supervisor
Rodolfo Espinosa /Process Engineering	PhD	1989	2003	KTH, Dept of Chemical Engineering, Joaquín Martínez (JM)
Javier Ramirez / Process Engineering	TkL	1996	2001	KTH, JM
Martha Benavente /Process Engineering	MSc	1999	2002	University of Chile, Jesús Casas (JC) and KTH, JM
Claudia Martinez /Process Engineering	MSc	1996	2001	University of Chile, JC, and KTH, JM
Marcia Vargas / Drying	MSc	1994	2001	KTH, JM
Leandro Páramo / Drying	PhD	1999	2002	KTH, JM
Rafael Gamero / Drying	PhD	1998	2002	KTH, JM
(Sergio Luís García / Drying, left in 2001) Replaced by Francisco Vilchez in 2001	TkL Tkl	2000 2001		KTH, JM
Indiana García /Waste Water Treatment	PhD	2001		KTH, Dept of Chemical Engineering Luis Moreno
Larisa Korsak / Waste Water Treatment	PhD	2001		KTH, Dept of Chemical Engineering Luis Moreno

10.3.2.5. Electrical and Computing Engineering Programme

The SAREC programme in Electrical and Computing Engineering Programme was agreed upon in 1991. The following year the first two students began their PhD studies. The research areas selected were industrial control systems and data communication. During the 1990s Sida gave support to the upgrading of some of the energy generation plants in Nicaragua, and the choice of industrial control systems fitted well into this support. The Faculty had some teachers with experiences in the selected areas acquired through international courses. There was also a basic laboratory infrastructure installed for the undergraduate training.

When the cooperation began, the Dean of Faculty was invited to establish contacts with potential Swedish counterparts. An agreement was signed between UNI and the Department of Industrial Control Systems at KTH. The first two years the students also assisted courses in Data Communication at the Linköping University.

The Industrial Control Systems research area was first focused towards the formulation of strategies as part of a decision support system to control the electrical power supply distribution network in Central America. With the privatisation of the energy sector, the topic was geared towards strategies and information systems for electrical energy market in the region. The data/radio communications area deals with the design of system applications for wireless data communication. A new area, Applied Electronics was added in 1998. The research addresses the design of subsystems for measurements and communication in industrial systems. Potential users of the systems are the Nicaraguan process industry, for example in the sugar cane and dairy products factories. The counterpart institution is the Dept of Applied Electronics at Lund Institute of Technology (LTH).

In the mid 1990s, the research cooperation was experiencing similar problems as the Chemical Engineering programme have had a few years earlier. A new Dean of Faculty was elected with little sympathy for research activities. As a consequence internal conflicts arose that severely disturbed and delayed the SAREC programme. However the programme managed to overcome these difficulties, and the present faculty administration has a very positive opinion of the cooperation. Currently, five students are involved in the SAREC research-training programme. (See table 3).

Table 3: Student currently involved in the Sida/Sarec research-training programme in Electrical and Computing Engineering:

Student / Project	Degree	Starting year	Expected year of completion	University, supervisor
Leonel Plazaola / Industrial Control Systems	PhD	1993	2001 (TkL) 2003 (PhD)	KTH, Dept of Industrial Control Systems, Torsten Cegrell
Enrique Silva / Industrial Control Systems	PhD	1997	2003 (TkL) 2006 (PhD)	KTH, Dept of Industrial Control Systems, Torsten Cegrell
Oscar Somarriba / Data Communication	PhD	1992	2004	KTH, Radio Communication grp.Jens Zander
Marvin Sánchez / Communication	PhD	1996	2002 (TkL) 2004 (PhD)	KTH, Radio Communication Data grp.Jens Zander
Marvin Arias / Electronics	PhD	1998	2003 (TkL) 2006 (PhD)	LTH, Dept of Applied Applied Electronics,Bengt Mandersson

10.4. Methodology

10.4.1. Methods and Approaches

The findings presented in this report are based on personal interviews and group meetings with the Nicaraguan and Swedish counterparts. During the evaluation process, two workshops were held in Nicaragua, and written documents provided by Sida and UNI were studied.

An initial evaluation workshop was held at UNI in June 2001. Approximately 30 members of staff participated including: the Rector of the university, Vice Rectors, Director of Research, Deans of the Faculties of Electrical and Computer Engineering, and Chemical Engineering, SAREC programme coordinators, SAREC students and teachers at the university. Following a presentation of the university

and the SAREC programme, selected key concepts were discussed through group and plenary sessions. The concepts put forward for discussion were for example: research capacity building; critical mass in research; sustainability; ownership; and impact of research programmes in society. (For workshop programme and list of participants see appendix C).

In February 2002, a second workshop was held presenting the draft findings and recommendations of the evaluation. Through a participative process using the reflecting team approach, the participants were invited to give comments to the evaluation and discuss selected key topics identified as of relevance for the future cooperation with SAREC. The three topics were: the roles of the different stakeholders in the cooperation; the sustainability of research within the university; and finally how to continue research activities once the SAREC programmes are completed. (For the February 2002 workshop programme and list of participants see appendix D).

In May 2001, Group meetings were held with the Swedish counterparts at the Royal Institute of Technology¹, and the Lund University². Group meetings were also held at UNI in June 2001.

Individual semi-structured interviews were held with (i) Students in the SAREC programme, (ii) Some teachers and/or staff at the two faculties not directly involved in the SAREC programme, (iii) Programme coordinators in Nicaragua and Sweden, (iv) the Deans of the Faculties of Electrical and Computing Engineering, and Chemical Engineering (v) the Rector, Vice Rector General, and Director of Research at UNI.

The same basic questions, letting the interviewees speak freely on the subjects, were basically asked in both the individual interviews and the group meetings. The general written comments and indications were pondered and compared with responses and commentaries to the questions discussed in the semi-structures interviews.

Two different questionnaires were given to academics involved in the SAREC cooperation. Questions were divided into four clear-cut categories to facilitate the quantitative analysis. In addition, one section for general comments was allowed. Specific qualitative questionnaires were given to the team leaders of each group. The questionnaires were filled anonymously, included in a closed envelope and personally collected by the evaluators.

10.4.2. Scope and Limitations

As mentioned previously, this report refers to the Sida/SAREC cooperation at UNI. The general conclusions and recommendations will therefore be found in the main document.

As stated in the Terms of Reference (see appendix A) this evaluation focus mainly on research project activities, efficiency of training, efficacy of the collaboration between the Swedish and Nicaraguan counterparts, and the viability and sustainability of the projects performed within the academic context of UNI. A more general perspective on the public universities and their role in the Nicaraguan society has been looked into by another study³.

According to the Terms of Reference the evaluation should also look into the UNI library support. However, this is unfortunately left out from the document, as the former team leader and who was expected to do this section, did not complete the assignment.

Though the large majority of the individuals taking part in the PhD training were interviewed. The

¹ Dept. of Chemical Engineering, Dept of Industrial Control Systems, Royal Institute of Technology

² Dept. of Applied Electronics, Lund University/Lund Institute of Technology

³ Reference to the study that will be carried out by Dr Tünnermann

report does not aim at scrutinize each of the individual projects, but rather point at the general conclusions, suggestions and recommendation that can be drawn from their experience. In the same manner in the context of capacity building, the main focus has been on the impact on the research cooperation at faculty and university level.

10.5. Findings

10.5.1. Programme at Faculty of Chemical Engineering

10.5.1.1. The Nicaraguan Perspective

There is a general agreement on the benefits of the SAREC support and its positive effect both for the faculty development, and on the individual level as an option to acquire comprehensive research training. There are many advantages with the Sandwich model as it allows the student to maintain employment and contacts with the university. To combine research and teaching is perceived as positive and mutually benefit the quality of both activities.

On the other hand, “the workload at UNI in terms of administrative tasks and teaching is too high. A lot of time is also wasted while waiting for laboratory equipment deliveries and clearings of equipment at the Customs. So very little time is actually left for doing research”. Many students said that almost all research is done when they are in Sweden. From the individual perspective, the time it takes to finish a degree in the sandwich model is far too long. A lot could be done to make the cooperation more efficient. For example better communication and programming of the stays in Sweden. “As for now, it difficult to plan, for example because the information on the KTH website about courses is not very reliable. Sometimes a course is cancelled only a few weeks in advance”. All were of the opinion that the grants given for stays in Sweden are too low: “They do not cover the loss of income in Nicaragua, and therefore makes it difficult to maintain their families”.

The research cooperation needs to “be institutionalised within UNI – so that research counts equal as teaching and administrative tasks”. Most students agreed that many thing had improved over the last few years, and “though a lot of things could be handled more efficiently by the present university and faculty leaders, they are positive to research and to the SAREC cooperation. But there is no guarantee that this situation will prevail over the next university elections”.

Among the SAREC students, there are different opinions regarding ownership of the programme and on symmetry in relations to the Swedish counterpart. All agreed that the relation to the counterpart is generally good, and there are many advantages of having a supervisor that pays frequent visits to Nicaragua and that knows well the situation at UNI. Some students would prefer to have more influence on the choice of research topics and supervisors when new projects begin. Particularly for the MSc studies/thesis that are done in cooperation with the University of Chile. Though the relation to the supervisor is good, most students would like to have more of exchange and collaboration with the Swedish department. “As for now, the Nicaraguan group is very isolated from the other research students at KTH”.

10.5.1.2. The Swedish Perspective

The former Head of Department of Chemical Engineering, Fredrik Zetterwall, and then his predecessor Åke Rasmussen used to supervise two of the students. But the last years, Joaquín Martínez, has been the sole supervisor to all the eight Nicaraguan PhD candidates. Luis Moreno at the same department will supervise the two newcomers in the programme (autumn 2001). Joaquín Martínez was one of the initiators and is still very dedicated to the programme. He has decided to give priority to support the Nicaraguan PhD students, apart from the work as teacher at the department.

According to Martinez, the programme after passing difficult times 1994 – 1998, has improved in efficiency over the last five years. The SAREC support has had a positive impact on the Faculty of Chemical Engineering (UNI), for example all teachers are thanks to the programmes relatively qualified (BSc or MSc). One of the major constraints for the Nicaraguan students is the economic situation during their stays in Sweden. “Many of the students have extra sources of income besides the salary from UNI to maintain their families. When in Sweden they do not have these additional incomes, and the SAREC grant is not enough to cover the deficit. In 1997, a proposal was made to SAREC to provide an additional grant as an incentive for researchers. Unfortunately the UNI did not pass the proposal at first, and then SAREC decided to not support the idea. So the problem remains unsolved”. Another point of concern is that UNI does not give sufficient attention to the needs for improved spaces for the laboratories.

The students are very dedicated to their research activities in Sweden, when back in Nicaragua it is not so easy to maintain the same level. To gain in efficiency, 80% of the time in Nicaragua should be spent on research. Martinez considers that in spite of the longer time it takes to obtain the degree, the sandwich model has proved to be successful. “Especially if compared with other programmes where students went away for 4–5 years, and none of them returned to UNI afterwards. – So one could say that the Sandwich system is better for the university but maybe not so advantageous for the individual student”.

A positive step has been the contacts established with the University of Chile. It has given an opportunity for the students to study up to the MSc in Spanish, and then continue for the PhD in Stockholm. It also a way for UNI to acquire new potential research cooperation contacts.

10.5.1.3. Achievements

In the Chemical Engineering programme, 6 TkL thesis and so far no PhD thesis have been produced. Out of the six TkL, only one, Rodolfo Espinosa remains with the faculty. The other five left during the “difficult years” 1992-1995. Three found highly qualified employment within the Nicaraguan process industry. The other two continued their studies outside the SAREC programme as KTH students in Stockholm. They obtained their PhD degrees in 2001. One has permanently settled down in Sweden, and one returned to Nicaragua after finishing the PhD.

The present members of the SAREC programme, has managed to establish small research groups in their areas of research (drying and process engineering¹). These groups consist of the SAREC programme members in the area and the undergraduate students they are supervising in their thesis work. All the PhD students that have been in the programme for more than four years have published research results in international journals and/or presented at international congresses (see table 4). Some of them according to the supervisor, in publications of very high reputation, though it is in general proved to be difficult to get material accepted in the first rate publications within the programme. On the other hand, very few of these papers have been presented recently (see table 5).

¹ The two new students in the area of waster water treatment, only started in autumn 2001, and has therefore not yet established a research group.

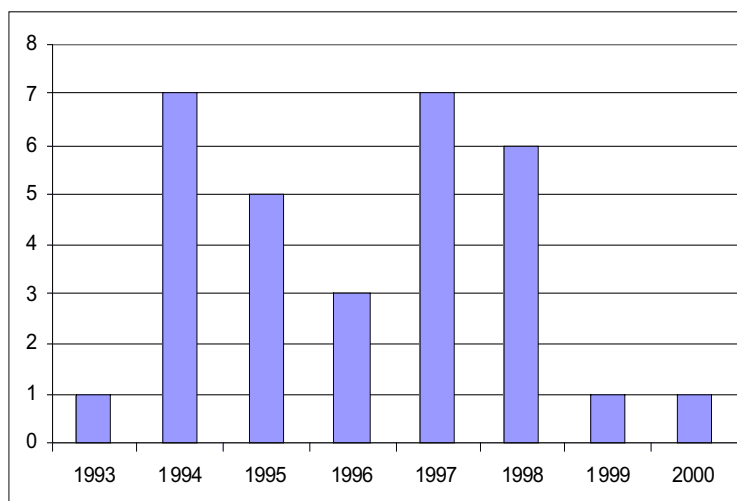
Table 4: Chemical Engineering Programme, submitted and/or published papers and posters from 1993 and onwards *).

Research area	National	International published vs. (submitted)	Total
Crystallization	2	7	9
Drying	4	11	15
Process Engineering	4	9	13
Total	10	21	37

*) No publications before 1993, or after 2000 were reported to the evaluation team

Figure 1: Chemical Engineering Programme, frequency of submitted and/or published papers and posters in national and international publications from 1993 and onwards.

(Note: as complete information on dates of publication was not available at the time of preparing the report, six papers published earlier than 1998, are excluded from the total of 37 papers mentioned in table 2)



As the SAREC PhD students carries out other tasks at the faculty, there is a direct link between research, supervision of undergraduate students and teaching. For example, during the period 1988 – 2000 the SAREC PhD students supervised 16 of the 32 approved BSc produced at the faculty. During 1994 – 2001 they also supported 12 MSc thesis produced by KTH students in Nicaragua. The SAREC students generally look upon this as a positive part of the cooperation, though occasionally it takes to much time from their own research activities.

The links to private sector are few but rather well established. Especially with industries where former participants of the programme are now working. As the process industry is very small sector in Nicaragua, the number of potential contacts is limited. Still, the quality of the existing contacts seems to be very good. For example with the Café Soluble (instant coffee), Esso (oil refinery), and the Sugar cane factories. In these companies, former SAREC students (TkL degree) hold significant posts, as Directors of production and process quality. In the case of Café Soluble, the two former SAREC students have played a substantial role in improving the quality of the processes, including an ISO 9000 certificate, as well as increasing the export market for its products. In several occasions BSc thesis, have been carried out in cooperation with industries

10.5.2. Programme at Faculty of Electrical and Computer Engineering

10.5.2.1. The Nicaraguan Perspective

According to the interviewees, the relation to the Swedish counterparts at KTH and LTH is very positive and constructive, both from a personal and scientific point of view. Since a programme coordinator was appointed at the department at KTH two years ago, the coordination and the “day to day” contacts have also improved considerably. KTH and LTH counterparts have also visited Nicaragua, more frequently than before, which is a very positive change. “These visits are very valuable for the cooperation, both in terms of the research activities and for a better general understanding of the conditions at UNI and Nicaragua”.

Some of the interviewees expressed a need to improve the individual study plans. Particularly the scheduling of courses at KTH: “From our perspective it seems as the PhD courses at KTH are implemented on an ad-hoc basis. It might not be so for the Swedish students. But at some occasions, planned courses were cancelled only a week in advance, and part of the objective with the stay in Sweden was lost. To our experience, the Linköping University seems to have a better approach. Their PhD courses are programmed for the first two years of the doctoral studies. If KTH had a similar system, our PhD training would not take so long time as today”. On the other hand fund management, logistic support and accommodation for the SAREC students are very efficiently handled by KTH and LTH”.

The interviewees agreed with the Chemical Engineering programme that, though many things had become more efficient at UNI with regards to administration of funds and the position of research, there are several things that can be further improved. For example the Scientific Council needs to consolidate itself and work more with research policy issues within the university. Further, the workload in teaching and administration is far too high to give enough time for research. Another problem is the lack of adequate space for research laboratory facilities within the faculty.

The sandwich model works rather well, though it takes too long time to finish the degree. “To make the model more efficient, the initial planning of each project, including courses could be improved. Then for the final part of the thesis work, the model should be more flexible, and for example allow a longer stay of 10 to 12 months in Sweden”. Another problem, according to the PhD students, is that the SAREC grant is not enough to cover for the loss in salary during the stays in Sweden.

According to the interviewees little has been said about what happens once they finish the PhD degree. “UNI, together with the collaborating universities and SAREC, should meet to discuss how to visualize the continuation of the cooperation – how to sustain research activities on a long-term basis”.

10.5.2.2. The Swedish Perspective

KTH- The objectives of the SAREC support are good, but from efficiency point of view the Sandwich model takes too long time. Especially if compared with our Swedish students. This makes it difficult to promote collaboration between Swedish and Nicaraguan PhD students, as the time factor is so different. Obviously the working conditions are very different in Nicaragua. But the Nicaraguan students must become more efficient and also improve their planning of the visits to KTH. The communication has improved considerably the last years, partly through better internet facilities at UNI. It is now easy to have frequent contacts with the students. The Nicaraguan students in the programme have good knowledge in English.

The work done by the Nicaraguan students is of good quality. “For example the latest paper published by Oscar Somarriba and Marvin Sanchez, are on the same level as any of our Swedish PhD students”. But the group today is too small, there should be at least two to four students working on the same topic.

It has proved that the research topics selected are relevant for the Nicaraguan context. “The SAREC students have gained experience through the research activities, knowledge that are much demanded within Nicaraguan industry. Sometimes there seems to be too much demand, which does not allow them to dedicate enough time for research”. The research topics are also interesting from a Swedish perspective, and the network established through this cooperation, may be useful for future contacts between Swedish and Nicaraguan companies.

From research capacity point of view, it is of course important to have research leaders at UNI with a PhD degree. For the Nicaraguan society it is important to count with qualified engineers that can take appropriate decisions on choice of technology. But, there might be not such a big demand for PhD's in the market. For most applications in the industry, an MSc degree from the Swedish system is good enough.

LTH – The project began officially in 1998, but in practice activities started in 1999. It has not been defined as a bilateral research collaboration, but rather as a support/supervision of a PhD student. After some initial problems, the project is running well. Better planning of visits to Sweden is needed. More time should also be spent on research in Nicaragua. Laboratory facilities and equipment at UNI needs improvement. To make the Sandwich model more efficient, the stays in Sweden should be at least 6 months.

As a university, UNI needs to have research and not only teaching. Therefore the SAREC programme is important. But the group of SAREC students at UNI is too small. There is an urgent need to give support to form a research group. If one of the more experienced PhD students leaves, it can prove to be very critical for the whole SAREC support. Regarding the academic levels, a PhD will of course be needed for the research leader. But not all need acquire a PhD. For teaching at the university a TkL is well enough.

10.5.2.3. Achievements

Since the programme started in 1992, one of the participants has obtained a TkL degree, but so far no PhD's. The SAREC students in Industrial Control System have established a small research group, while the two students in Data Communication has not yet managed to consolidate. The SAREC students have supervised 14 BSc thesis within the faculty, and also co-supervised Swedish MSc students. Some of them apparently of relatively high quality, as one of them were presented at an international congress. Two students from KTH have done their MSc thesis fieldwork at UNI. The SAREC students have also played an pivotal role in the development of the ICT project at UNI.

The SAREC students in Industrial Control Systems have published 2 papers in national -, 2 papers in international scientific journals, and have made presentations in 5 international conferences. Of these, 4 were published in 1998, 3 in 1999 and 2 in 2000 respectively. The area in Data Communication, is of more recent date, and has not yet published any results (see table 5).

Table 5: Electrical and Computing Engineering Programme, submitted and/or published papers and posters 1998 – *).

Research area	National	Internationalpublished vs. (submitted)	Total
Industrial Control Systems	2	7	9
Data Communication	–	–	0
Total			9

*) No publications reported before 1998

The programme has passed through periods when the “conjuncture” at faculty and university level has not been very favourable to research in general and the SAREC programme in particular. However they have managed to overcome these difficulties, and today the relations are very constructive both to the faculty and the university.

Links have been established with several private and public companies. The students have acquired technical skill through the SAREC programme, which enables them to carry out consultancies to the power industry, and other core industries in the private sector. Especially through the semi-independent consultancy company “Technosoluciones”¹. Several of the SAREC students has been part of studies and consultancies for example to Siemens, Enetel (telecommunication), Enel (power supply), Cosesna (aviation control systems), and Bell South in Nicaragua. One the SAREC student is also member of the “dot.com – committee” – that regulates the use of internet addresses in the country.

10.6. Conclusions and Recommendations

10.6.1. Issues in Common for the Two Programmes

The first sections discusses issues in common for both programmes, then specific recommendations for the chemical and computing programmes are presented separately.

Though the following text might focus mainly on aspects that needs to improve it is important to have in mind that a lot has been achieved in the cooperation over the years. Through the workshops and group meetings of the evaluation it was obvious that there is very open and constructive working environment at UNI. Achievements, problems and drawbacks are openly discussed among students, teachers and university leaders. Many of the issues brought up during the evaluation were also reviewed in a very constructive manner for example in the final workshop in February 2002, and are already part of the agenda of the university. Hopefully the evaluation has and will contribute to further encourage and strengthen such a process.

10.6.1.1. Fulfilment of Objectives

In general terms both programmes at UNI has progressed in fulfilment of the long-term objectives of the Sida-SAREC cooperation. Nucleuses of research groups have been established at both programmes - groups dedicated to analyse and carry out research of relevance for the development of society in Nicaragua. The UNI strategic plan, the formation of the Research Council and the progress of the ICT project are also important steps towards a sound and viable research environment. Good links have been established with the productive sector, though they could be further extended. The presence of the SAREC programme has also had a positive effect on the quality of the undergraduate education.

On the other hand there are several issues of concern: (i) At least one researcher with a PhD degree is needed in each research group and so far, in spite of 12 and 17 years respectively² of SAREC - UNI collaboration, no PhD's have graduated within the programmes; (ii) the ability of the university to keep skilled staff once they graduate; (iii) the dependency on SAREC financial support and scientifically on the Swedish supervisors/counterparts to maintain research activities.

Both faculties have had successful cooperation programmes through other donor's. Especially in MSc training and some support to laboratories combined with individual research project activities.

¹ Technosoluciones is a firm of consultants that enables the teachers and researchers at the Faculty to carry out services to the private and public sector. Is established on the premises of the Faculty but administred autonomously.

² 18 years for the Chemical and 12 for the Computer Engineering programme

Nevertheless, the SAREC support has been the most important support. Without the long-term commitment to research capacity building by SAREC, and UNI teachers dedicated to research training, neither of the two faculties would probably have any research capacity today. As mentioned before, the initial conditions of the programmes were not the most favourable, both in terms of human resources and infrastructure. Still, 17 years of cooperation is a long time period, and one could expect that at least the Chemical Engineering programme had managed to produce one or two PhD's that now could carry the research activities further – to a more symmetric relationship with the Swedish counterparts, and to create new research projects and international research contacts with other universities.

10.6.1.2. Sustainability

Sustainability in this context is interpreted as a condition where a research group has reached a capacity level that enables them to attract sufficient amount of research funds from national government, international funds or private sector contribution, to continue research activities and further build up their capacity. This is an ambitious goal, and a struggle also for many research groups in the industrialized countries including Sweden. In the case of Nicaragua, the options are even fewer as the national government does not allocate funds for research activities. The present university budget does not contemplate allocation of resources to research. Though links to private sector exists, they are not in the condition or willing to financially support large research projects. The universities will therefore in the foreseeable future depend on international research funds to maintain any research activities of importance.

On the other hand, if the ambition is set slightly lower, excluding the financial aspects, as the capacity to carry out high quality research and establish research cooperation with their Swedish counterparts or other research groups - they might be not so far away. Both the programmes have managed to establish small research groups in areas of relevance for society. Both programmes should, provided that research activities is given due priority, be able to produce PhD's within the next one or two years. Nevertheless, apart from the priority of research, there are two critical factors that might influence this process in a negative way: (i) the ability of the university to keep a critical mass of researchers once they obtain the PhD degree, (ii) the electoral system at faculty and university level.

Ability to maintain a critical mass of research capacity

Both research programmes addresses relevant areas for development of the Nicaraguan industrial sector. When beginning the cooperation, SAREC and the universities involved, obviously managed to select strategic research areas. As a consequence, staff trained through the SAREC programme is attractive on the job market. Or as one of the SAREC programme members put it: "The problem from the faculty point of view is not so much the slow progress of the individual research projects, but rather that the PhD students will look for better work opportunities in the private sector as soon as they finish their degree. - In consequence the research capacity built will be lost for the university". One can always argue that from a more general national development point of view, the resources are not lost for society if they leave university and work somewhere else. Nevertheless, as a main objective is to create well functioning research environment within the collaborating universities, one has to consider the ability to keep a critical mass of researchers within the university as imperative for the success of the programme.

Many of the interviewed SAREC students argued that it is difficult to keep the motivation for research, given the low salary level and the lack of incentive system. There are very little incentives for doing research, as the present system favours teaching in the under/graduate programmes. No comparative study of salary levels was done in the evaluation. In comparison with public sector employment, the

university lecturers have certain advantage, but the private sector may offer better conditions. Several of the SAREC students also work extra hours as lecturers at the private universities or as part-time consultants to complement the UNI salary. To my opinion setting of salary levels and salary incentives for research activities are in first hand an internal issue to be solved by UNI as part of a strategy to make research activities sustainable, and not so much a task for SAREC to solve.

It is therefore an urgent need to define a strategy that allows the university to develop an incentives system that makes research an attractive option. Such a system could for example include: (i) salary incentives for researchers based on efficiency, numbers of papers published in qualified international journals, supervision of MSc thesis, etc. (ii) recognition of research activities equal as teaching, (iii) discuss with SAREC possibilities of limited post doc programmes as to give the graduated researchers (PhD) options to continue activities and expand contacts to other universities/researchers, (iv) expand and encourage further the use of the research funds managed by the scientific council. One option to at least partially finance the research funds and the salary incentive system could be to further develop consultancy services. Even though one should be careful when combining consultancy and research activities. A clear division between the two must be defined.

Electoral System at Faculty and University level

Today the undergraduate students are in possession of the majority of votes in the elections of heads of faculty and university level. Students should of course be able to take part in the decision making process, but not to the extent where they actually determine who is going to be Rector of the university and Dean's of the faculties. This rather populist system has at several occasions led to instability and drastic policy changes from one administration to another. It is important to stress that conditions at present are favourable for research development both at faculty and university level. Still there is a risk that these achievements will be lost in the next university elections, and in consequence the SAREC programme may very well experiences similar set-back as they have done before. The election system is not only a concern for UNI, but for the other public universities as well. Preferably, the National University Council (CNU) could deal with this problem. On the other hand, as this concerns national legislation, it is probably a politically complicated and delicate issue to address, and will therefore take long time to amend.

10.6.1.3. Research Policy

It's the impression of the evaluation that the National Council for Science and Technology is very weak and does not seem to have the ability to formulate or implement any congruent research policy. On the other hand CNU has taken some important steps in this direction (see the main report), and at the "local" level efforts have been made by UNI over the last years to modernize the university. Through the Strategic plan 1998-2010, a common agenda has been agreed upon for the development of the university. The strategy is also the basis for further integration of research and research capacity building. This is definitely a very positive development and this process should be encouraged.

It is therefore very important to make use of the momentum and to operationalize an internal research policy at UNI based on the outlines made in the strategy. The mandate of work for the Research Council should therefore be further strengthened. A prioritised area should be to work for an integration of research activities to be counted for equally as education within the university. The Research Council could for example prepare an action plan for research capacity building at faculty level. Such an action plan would include a strategy for how to "make best use of" the SAREC students after finishing their degree, or in other words how to create stimulating and efficient research environments to further build up the critical mass of researchers. The objectives (short- and long-term) of the SAREC cooperation could also be used as a point of departure for the work to detail such a plan.

10.6.1.4. The Sandwich Model

The sandwich model is well accepted by the parties involved. Though it means longer time for the individual student to get the degree, there is a general agreement on its positive impact of the model on the long-term capacity development of the university. Still most of the interviewees argued that it takes too long time to obtain a PhD degree. Obviously, 10-12 years for a PhD, or in some cases even more, indicates that there are problems with the efficiency of the programme. The problem seems to be general and endemic for both the Chemical and Computing programmes. To my opinion this has not so much to do with the Sandwich model as such, but rather reveals weaknesses in programming of the individual research projects, as well as deficiencies in the administration of the research cooperation at UNI.

If the SAREC collaboration with UNI shall continue, these deficiencies should be thoroughly discussed among the collaborating parties, and a short-term action plan for how to overcome these should be agreed upon.

The slow progress can be explained by a number of internal and external factors that needs to be addressed:

Poor planning of the individual research project:

The scheduling of courses for the SAREC students at KTH/LTH could be improved. According to the students, in several occasions courses have been cancelled just a week or a few days in advance, which means that the student had to wait until the next year to attend the course. Once the research topic is agreed upon, the PhD student together with the supervisor should be able to identify, all the basic courses to be taken and approximately when they take place. They should preferably be carried out during the first two years of the programme. Then, after completing the basic courses, the student should be encouraged to choose/have the possibility to select courses at other universities in Sweden or abroad. This would probably benefit both the student, in selecting the most appropriate courses and UNI, as it broadens the contact network with other universities.

At the final stage of the PhD project, a longer stay of 6-8 months in Sweden to complete the synthesis of the work, would probably speed up the process.

Time allocation for research vs. teaching and administrative tasks:

The time in Nicaragua is to large extent spent on teaching and administrative work (see table 6). Many of the SAREC students are engaged on leading administrative posts. It is of course not an easy task to combine the duties of Dean of Faculty and at the same time be committed to your PhD studies. It is, therefore not recommended that the SAREC students should not hold administrative or management positions at the faculty/university while they still are in the programme. If a PhD student decides to take on such a management task, it is probably better it they leave their place in the programme to another student. A time distribution of 70% research and 30% teaching would probably prove beneficial for the advancement of the programme.

Table 6 Relative work time distribution for the Sarec students

	Research			Teaching			Administration		
	<25%	25-50%	>50%	<25%	25-50%	>50%	<25%	25-50%	>50%
Chemical Eng Progr (7 respondents)	4	3	0	0	5	2	4	3	0
Computing Eng Progr (3 respondents)	0	3	0	0	2	1	2	0	1

When a student enters the programme, these conditions should be clearly stated, as it is in interest of all parties involved to reduce the time it takes to obtain a PhD.

Role of the Swedish supervisor:

The Swedish supervisor should play a more active role and follow up closely also how the time is spent in Nicaragua. Apparently, the yearly plan of each individual project is seldom fulfilled. It is important that the supervisor pays yearly visits and gets familiar with the conditions in Nicaragua so that she/he can support the student to set clear and realistic goals for each semester. Maybe efficiency goals could be formulated that enables the supervisor to recommend students and/or SAREC to end PhD projects that are not showing any results over a certain time period.

Among the Swedish supervisors, there seems to be different views on the role they play in the cooperation. To my opinion, even though a key task is to supervise the PhD student, it is important that all supervisors also share a wider perception of their role in the research capacity building.

Improve contacts/exchange between the collaborating faculties:

There are some positive steps already being made to extend the collaboration. One example is the course KTH counterpart gave at the Faculty of Electrical and Computing Engineering. Though, joint research project between Swedish and Nicaraguan PhD students are difficult to implement due to the character of the sandwich programme, one should look further into the possibilities for the Nicaraguan students to participate in research groups in Sweden. At present there seems to be very little contacts between the Nicaraguan SAREC students and the Swedish students at the collaborating departments.

Improved handling of laboratory equipment purchase:

According to the SAREC students, a lot of time is wasted for each student in customs clearance of equipment or just waiting for the delivery of equipments. If the custom clearance detail were taken care of at the central administration at UNI instead, a lot would be gained in terms of efficiency.

10.7. Conclusions and Recommendations – Chemical Engineering Programme

The collaboration with the Faculty of Chemical Engineering is a clear example on how the SAREC programme has developed over time, from problem solving to support research capacity building as part of a wider knowledge system. The “SAREC group” was according to the interviews in June 2001, large within the Faculty, about 50% of the teaching staff involved in different levels of the SAREC programme. If this had been the case, the SAREC students would also have had a relative large influence on the quality of the education and BSc thesis work. Unfortunately, according to later comments made by the Swedish and Nicaraguan Programme Coordinators and the Dean of Faculty of Chemical Engineering, this was probably an overestimation, and a more correct figure would be 20%.

Research seems to be respected as an integrated part of the Faculty’s activities (though this is not reflected in salary or other incentives). Most of the SAREC students have published their results in international congress proceedings and scientific publications. Though progress have been slow there is a dedicated and qualified group that in a few years time should be able to continue research on their own or with less support from SAREC. Three students are expected to finish the PhD, 2 TkL, and 3 MSc degree within the present period (2001-2003). With three PhD’s and the combined experience acquired by the SAREC programme members, the Faculty have probably a sound basis to formulate a strategy for how to continue research activities more independently in the future.

10.7.1. Step-wise phasing out of the chemical engineering programme

It is therefore recommended to prepare for a phasing out of the support to the programme in process engineering and drying. Priority should be given for the students to finish the degrees as stated in the 2001 activity plan. For example students that according to the activity plan are expected to complete the TkL degree within the period 2001-2003 would do so but not continue to the PhD level within the SAREC programme. The phasing out should preferably be made in a step-wise approach as to ensure that enough time is given to the research groups to adjust to the new conditions so capacity will not be lost when the SAREC support ends.

Such a phasing out plan could include for example a three to four year bridging support:

- (i) Funds for limited post-doc research activities
- (ii) Complementary laboratory equipment and maintenance programme
- (iii) Formulation of strategies for obtaining financial support from other sources than Sida
- (iv) Establish new research contacts and formulate joint research projects with the existing partners at KTH and University of Chile that could be financed through other sources than Sida
- (v) Surveys of the need within the food processing industry in Nicaragua, in order to find new relevant areas for research and maybe also for the provision of consulting services
- (vi) Ways of collaboration with the new centre for environmental studies CIEMA at UNI should also be looked into. A feasibility study of CIEMA has been done separately to this evaluation (Alveteg, 2001).

10.7.2. The newly started support in environmental engineering

The new support in waste and drinking water treatment with two students started in September 2001. Both candidates have previous experience in the field through a Dutch supported project. As stated in the preliminary plans, the environmental engineering programme should be transferred to CIEMA, once the centre has been properly established. As some laboratory infrastructure are available at PIDMA and the Biomasa programme, that also will form part of CIEMA, it is recommended that any purchase of equipment for the waste and drinking water project should be coordinated with them.

10.7.3. Strategy for the research laboratories

The impression of the evaluation is that the research laboratories have been developed more on an ad-hoc basis, according to the immediate needs of each research student, then following any specific objectives and plan for laboratory development. The laboratory spaces are also in rather poor conditions and do not have the appearance of a research laboratory. One could of course argue that the laboratories have been developing organically along with the research collaboration. Still, considering the long-term commitment of the collaboration and the investments made in expensive equipment, it is recommended to formulate a strategy for development of the research laboratories on short- and long-term basis.

10.7.4. Relation to the Swedish counterpart research environment

As mentioned previously, there is a good relation to the Swedish supervisor Dr Joaquín Martínez the last years supervised all the eight SAREC students in the drying and process engineering projects. He has a long experience of working with Nicaragua, and a clear vision of the objectives of the cooperation. Still it is not an optimal situation where all contacts are focused to one sole supervisor at the collaborating department. It is therefore very positive that Dr Luis Moreno will supervise the two students in the new project in wastewater treatment.

To my opinion there seems to be too much of reliance on the Swedish supervisor. The Faculty at UNI, and in the future CIEMA in the wastewater treatment project, needs to gain more initiative and reach a more symmetric relation to the Swedish counterpart. A dialog with KTH on how to widen the existing research contacts would probably prove beneficial for both parties.

10.7.5. Competing research areas/projects within the Sarec support

The research projects in the area of process engineering (lixiviates from mining waste disposal sites) carried out by Ramirez and Benavente concerns areas of potential interest for CIEMA. In order to avoid internal competition within UNI, it is important to define if this area of research should remain with the Faculty of Chemical Engineering or be transferred to CIEMA.

At UNAN-Managua, SAREC is supporting research projects in similar areas. Though competition is positive in general, it is probably not such a good idea to compete in this case considering the limited resources and capacity available. Maybe the research groups at the two universities could meet to define common areas of interest and how to best complement their research.

10.8. Conclusions and Recommendations – Computing and Electrical Engineering Programme

The members of the SAREC programme in Computing and Electrical Engineering are a dedicated group that over the years has gained considerable experience in their respective fields of research. But in terms of progress of the SAREC programme per se, there seems to be similar drawbacks as for the one in Chemical Engineering. Several of these factors shared by both programmes, have been discussed in previous sections. One could argue that considering the poor outcome in terms of academic degrees – one TkL and no PhD's graduated since 1992, the best recommendation would be to consider closing down the programme. Nevertheless, as mentioned in section 4.2, there are other tangible results of the cooperation that well merit further support to the programme. The SAREC students, though not been able to finish their studies, have managed to play a part in the development of Nicaraguan industry through various consultancies - to large extent based on the knowledge and experiences gained in the SAREC supported research activities.

With regards to the slow progress of the SAREC supported research projects, there might be several plausible explanations: (i) the programme has not always been of high priority within the Faculty; (ii) research topics initially selected not always of priority for the Nicaraguan context (but in these cases, in dialogue with the supervisors they have manage to adjust the research topics); (iii) the SAREC students have not always given priority to research, (iv) the Swedish supervisors may not always had given enough attention to the programme; (v) SAREC students spend to much time on administrative task at UNI, (vi) and finally that there is a big demand for the skills of the SAREC student in private sector consultancies. However the impression of the evaluation is that performance have improved slightly over the last two years, and the fact that a programme coordinator has been appointed at KTH has improved efficiency in the regular contacts and follow up of the performance of the individual research projects.

10.8.1. Increased support to the Computing and Electrical Engineering Programme

The fields of research selected in the programme are of high relevance for the industrial sector in Nicaragua. From the national development point of view, it is also important to count on highly skilled professionals within the country, and not rely only on international consultancies. The support is therefore probably of strategic importance for Nicaragua. From research capacity point of view, the SAREC team is relatively small and vulnerable to changes: 2 students each in Industrial Control Systems, and Data Communication respectively, and 1 student in Applied Electronics. The probability to maintain a critical mass of research capacity would improve if the programme were extended.

It is there recommended to look into the possibilities to extend the programme with 2 or 3 more students.

10.8.2. Improve performance of the students already in the programme

However before taking any decision on extension of the programme, the issues discussed regarding sustainability and the sandwich model needs to be addressed. Particularly important is to look for ways to maintain a critical mass of researchers within the university. Further, the efficiency of the individual research needs to be improved, through better planning and frequent contacts with the supervisor(s). The time allocated for research in Nicaragua must be increased. The students that entered the programme before 1995 should give priority to finish their degrees (TkL or PhD) within the next year. An option could be to permit a longer stay in Sweden to accomplish this.

10.8.3. Contribution by the Swedish supervisors

The perception of the evaluation team is that at least historically there have been conceptual discrepancies between SAREC, Nicaraguan counterparts and the Swedish supervisors on the scope of the cooperation. There has been a certain progress in this respect over the last two to three years. However, it is important to emphasise the need for the Swedish counterparts to not limit their scope to supervision of individual PhD students, but rather as a part of the research capacity development at the collaborating university.

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12. Annexes

12.1. Contacted or Interviewed Personnel at the Public Universities of Nicaragua, Companies and Institutions

Name	Position	Institution/office	Place
ALBERTO SEDILES	VICERRECTOR STUDENTS	RECTORY	UNA
ALDO ROJAS	PROJECT PARTICIPANT	FAGRO	UNA
BENIGNO GONZALEZ	PROJECT PARTICIPANT	FARENA	UNA
CAJINA ARIEL	DECANO-	FACULTY OF ANIMAL SCIENCES	UNA
CARLOS RUIZ	PROJECT PARTICIPANT		UNA
DENNIS SALAZAR	DEAN	FACULTY OF AGRONOMY	UNA
EDUARDO UMAÑA	PROJECT PARTICIPANT	FARENA	UNA
FREDDY ALEMAN	PROJECT PARTICIPANT	DIEP	UNA
GERARDO U. MURILLO	DEAN	FACULTY RURAL DEVELOP.	UNA
GUILLERMO CASTRO	PROJECT PARTICIPANT	FARENA	UNA
GUILLERMO REYES	PROJECT PARTICIPANT	FAGRO	UNA
IVETTE SANCHEZ	DIRECCIÓN DE DOCENCIA	RECTORY	UNA
JAVIER LOPEZ	VICE- DEAN	FACULTY NATURAL RESOURCES	UNA
JIMMY HUECK	GRADUATE SCHOOL	DIRECTOR	UNA
JOSE DOLORES CISNE	PROJECT PARTICIPANT	FAGRO	UNA
JUANA LOPEZ	DIRECTOR	FINANCING OFFICE	UNA
LUIS CATELLANOS	DIRECTOR PLANIFICACI" N	RECTORY	UNA
MARGARITA CUADRA	PROJECT PARTICIPANT		UNA
MARGARITA ROMANO	PROJECT PARTICIPANT	FAGRO	UNA
MATILDE SOMARRIBA	PROJECT PARTICIPANT	FARENA	UNA
MIGUEL RIOS	PROJECT PARTICIPANT		UNA
NADIR REYES	PROJECT PARTICIPANT		UNA
OSCAR JOSE GOMEZ	PROJECT PARTICIPANT	FAGRO	UNA
RUTH DELIA GOMEZ	DIRECTOR	CENIDA	UNA
SANDRA ESQUIVEL LINDO	DEAN	STUDENT AFFAIRS	UNA
SANDRA MA LOVO	DIRECTOR	EXTERNAL COOPERATION	UNA
SILVANA PICON	ADMINISTRATION DIRECTOR	RECTORY	UNA
TELÉMACO TALAVERA	RECTOR	RECTORY	UNA
VICTOR AGUILAR	COORDINADOR	RECTORY	UNA
VICTOR BLANDON	EXECUTIVE SECRETARY	FAITAN	UNA
VICTOR SANDINO DIAS	PROJECT PARTICIPANT		UNA
ADABERTO MEMBREÑO	PUBLIC SERVICES	LIBRARY	UNAN-LEON
ALEXA PALMA	PROJECT PARTICIPANT	ANTIMICROBIAL RESISTANCE	UNAN-LEON
ALEYDA TELLES	COORDINATOR	PARASITIC INFECTIONS	UNAN-LEON
ALMA-DELIA PARAJÓN	CONTROL OF REFERENCES	LIBRARY	UNAN-LEON

ANDRÉS-E. HERRERA	PROJECT PARTICIPANT	REPRODUCTIVE HEALTH	UNAN-LEON
ARMANDDO MATUTE	PROJECT PARTICIPANT	ANTIMICROBIAL RESISTANCE	UNAN-LEON
AURA FÚNEZ	PROJECT PARTICIPANT	OCCUPATIONAL HEALTH	UNAN-LEON
AURORA ARAGON	COORDINATOR	OCCUPATIONAL HEALTH	UNAN-LEON
BAYRDO VILCHEZ	PROJECT PARTICIPANT	BACTERIAL ANTIGENS	UNAN-LEON
BYRON LEIVA	PROJECT PARTICIPANT	PARASITIC INFECTIONS	UNAN-LEON
DALIA UGARTE LIC	PROJECT PARTICIPANT	ANTIMICROBIAL RESISTANCE	UNAN-LEON
DINORAH MAGLIONE	PROJECT PARTICIPANT	MENTAL HEALTH	UNAN-LEON
EDGAR DELGADO	PROJECT PARTICIPANT	OCCUPATIONAL HEALTH	UNAN-LEON
EDMUNDO TORRES	VICERRECTOR OF RESEARCH	RECTORY	UNAN-LEON
ELIETTE VALLADARES.	PROJECT PARTICIPANT	REPRODUCTIVE HEALTH	UNAN-LEON
ELIZABETH MEYER LIC	PROJECT PARTICIPANT	PARASITIC INFECTIONS	UNAN-LEON
ELMER ZELAYA	PROJECT PARTICIPANT	REPRODUCTIVE HEALTH	UNAN-LEON
ERICK AMAYO	PROJECT PARTICIPANT	BACTERIAL ANTIGENS	UNAN-LEON
ERNESTO MEDINA	RECTOR	RECTORY	UNAN-LEON
EUGENIA CARERA	PROJECT PARTICIPANT	ANTIMICROBIAL RESISTANCE	UNAN-LEON
FELIPE URBINA.	CO-COORDINATOR	BACTERIAL ANTIGENS	UNAN-LEON
FELIX ESPINOZA	PROJECT PARTICIPANT	INFANT DIARRHEA	UNAN-LEON
FELIX ZELAYA	PROJECT PARTICIPANT	REPRODUCTIVE HEALTH	UNAN-LEON
GASTOR BERRIOS	PROJECT PARTICIPANT	ANTIMICROBIAL RESISTANCE	UNAN-LEON
IRELA ROMERPO	PROJECT PARTICIPANT	MENTAL HEALTH	UNAN-LEON
ISABLE ALTAMIRANO	PROJECT PARTICIPANT	PARASITIC INFECTIONS	UNAN-LEON
JAMILET MIRANDA	PROJECT PARTICIPANT	OCCUPATIONAL HEALTH	UNAN-LEON
JOSÉ-RAMÓN MORALES	PROJECT PARTICIPANT	MENTAL HEALTH	UNAN-LEON
JUAN CENTENO	PROJECT PARTICIPANT	OCCUPATIONAL HEALTH	UNAN-LEON
LUIS BLANCO	PROJECT PARTICIPANT	OCCUPATIONAL HEALTH	UNAN-LEON
LUISA DE LUGO	VICERECTOR ACAD. AFFAIRS	RECTORY	UNAN-LEON
LUVY MACHADO	LAW SCHOOL LIBRARY	LIBRARY	UNAN-LEON
LYLLIANN LÓPEZ	PROJECT PARTICIPANT	OCCUPATIONAL HEALTH	UNAN-LEON
MAGALY SÁNCHEZ	PROJECT PARTICIPANT	MENTAL HEALTH	UNAN-LEON
MARGARITA PANIAGUA	COORDINATOR	INFANT DIARRHEA	UNAN-LEON
MARVIN CAMPILLO	COMPUTER SCIENCES	LIBRARY	UNAN-LEON
MERCEDES CÁCERES	COORDINADOR	ANTIMICROBIAL RESISTANCE	UNAN-LEON
NESTOR CASTRO	PROJECT PARTICIPANT	OCCUPATIONAL HEALTH	UNAN-LEON
RICARDO CUADRA	PROJECT PARTICIPANT	OCCUPATIONAL HEALTH	UNAN-LEON
RODOLFO PEÑA	COORDINATOR	REPRODUCTIVE HEALTH	UNAN-LEON
ROSA-EMILIA ALONSO	PROJECT PARTICIPANT	INFANT DIARRHEA	UNAN-LEON
ROSARIO PALMA	PROJECT PARTICIPANT	PARASITIC INFECTIONS	UNAN-LEON
SUSANA QUIROZ	DIRECTOR	LIBRARY	UNAN-LEON
TRINIDAD CALDERA	COORDINATOR	MENTAL HEALTH	UNAN-LEON
WILLIAM MORALES	PROJECT PARTICIPANT	PARASITIC INFECTIONS	UNAN-LEON

ALFREDO MENDOZA	PROJECT PARTICIPANT	CIGEO	UNAN-MANAGUA
ANA MA. SANCHEZ	PROJECT PARTICIPANT	CISE	UNAN-MANAGUA
BISMARCK CONTRERAS	PROJECT PARTICIPANT	CIGEO	UNAN-MANAGUA
CARLOS ARIEL RUBI	PROJECT PARTICIPANT	CIGEO	UNAN-MANAGUA
CHARLES WALLOW	PROJECT PARTICIPANT	FACULTAD DE MEDICINA	UNAN-MANAGUA
DIONISIO RODRIGUEZ	PROJECT PARTICIPANT	CIGEO	UNAN-MANAGUA
ELVIS MARIA JIMÉNEZ	PROJECT PARTICIPANT	FACULTAD DE CIENCIAS	UNAN-MANAGUA
EVELYN HOOKER	PROJECT PARTICIPANT	CIRA	UNAN-MANAGUA
FRANCISCO GUZMÁN	RECTOR	RECTORY	UNAN-MANAGUA
FRANCISCO PICADO PAVÓN	PROJECT PARTICIPANT	CIGEO-CIRA	UNAN-MANAGUA
GUSTAVO SEQUEIRA	PROJECT PARTICIPANT	FACULTAD DE MEDICINA	UNAN-MANAGUA
JULIO C. TRAÑA	DIRECTOR POSGRADO	RECTORY	UNAN-MANAGUA
KATIA MONTENEGRO	PROJECT PARTICIPANT	CIRA	UNAN-MANAGUA
LENER SEQUEIRA	PROJECT PARTICIPANT	CIGEO	UNAN-MANAGUA
MARIO JIMÉNEZ	PROJECT PARTICIPANT	INIES	UNAN-MANAGUA
MARISSA ESPINOZA	PROJECT PARTICIPANT	CIRA	UNAN-MANAGUA
MARTHA LACAYO	PROJECT PARTICIPANT	CIGEO CIRA	UNAN-MANAGUA
MARTÍN ROMERO	PROJECT PARTICIPANT	FACULTAD DE CIENCIAS	UNAN-MANAGUA
MARVIN CORRIOLS	PROJECT PARTICIPANT	CIGEO	UNAN-MANAGUA
MELIDA FLORES	DIRECTOR DESARROLLO	INIES	UNAN-MANAGUA
ORLANDO CORTES	PROJECT PARTICIPANT	CINET-RUCFA	UNAN-MANAGUA
OTTONIEL ARGUELLO	DIRECTOR INVESTIGACIÓN	RECTORY	UNAN-MANAGUA
SILVIA HERNÁNDEZ	PROJECT PARTICIPANT	CIRA	UNAN-MANAGUA
STEVEN CUADRA	PROJECT PARTICIPANT	FACULTAD DE MEDICINA	UNAN-MANAGUA
TENORIO BELLANGER	OFICINA PLANIFICACION	RECTORY	UNAN-MANAGUA
TERESA MONTOYA	PROJECT PARTICIPANT		UNAN-MANAGUA
VALINDA SEQUEIRA	PROJECT PARTICIPANT	CISE	UNAN-MANAGUA
ARIEL ROLDAN	DEAN	FACULTY OF ELECTRICAL ENGINEERING	UNI
CLAUDIA MARTINEZ	PROJECT PARTICIPANT	FACULTY CHEMICAL ENGINEERING	UNI
ELISA VALLECILLO	PROJECT PARTICIPANT	FACULTY CHEMICAL ENGINEERING	UNI
ENRIQUE DE SILVA	PROJECT PARTICIPANT	FACULTY CHEMICAL ENGINEERING	UNI
EDWIN GARCIA	DIRECTOR	RADIOCOMMUNICATION	UNI
FIDEL SANCHES	PROJECT PARTICIPANT	SIEMENS	UNI
INDIANA GARCIA	PROJECT PARTICIPANT	FACULTY CHEMICAL ENGINEERING	UNI
JAVIER RAMIREZ	DEAN	DEPARTMENT OF MICROELECTRONICS	UNI
JUAN MARTINEZ	VICE DEAN	FACULTY OF ELECTRICAL ENGINEERING	UNI
JOAQUIN MARTINEZ	COORDINATOR SAREC PROG.	FACULTY ELECTRICAL ENGINEERING	UNI
LARISSA KORSKOV	PROJECT PARTICIPANT	FACULTY CHEMICAL ENGINEERING	UNI
LEANDRO PÁRAMO	VICE DEAN OF FACULTY	FACULTY CHEMICAL ENGINEERING	UNI

LEONEL PLAZAOLA	DIRECTOR OF RESEARCH	FACULTY OF ELECTRICAL ENGINEERING	UNI
MARIO CALDERA	RECTOR	RECTORY	UNI
MARCIA VARGAS	VICE RECTOR OF UNI	RECTORY	UNI
MARTHA BENAVENTE	PROJECT PARTICIPANT	FACULTY CHEMICAL ENGINEERING	UNI
MARVIN SANCHES	PROJECT PARTICIPANT	FACULTY OF ELECTRICAL ENGINEERING	UNI
NORMAN VARGAS	UNDERGRADUATE STUDENT	FACULTY OF ELECTRICAL ENGINEERING	UNI
OSCAR SOMARRIBA	PROJECT PARTICIPANT	FACULTY OF ELECTRICAL ENGINEERING	UNI
RAFAEL GAMERO	COORDINATOR SAREC PROG.	FACULTY CHEMICAL ENGINEERING	UNI
RODOLFO ESPINOZA	PROJECT PARTICIPANT	FACULTY CHEMICAL ENGINEERING	UNI
SERGIO GAMEZ	DIRECTOR	PIDMA	UNI
SERGIO LUIS GARCIA	PROJECT PARTICIPANT	FACULTY CHEMICAL ENGINEERING	UNI
EDWIN GARCIA	ENGINEER	DIRECTOR OF RADIO COMMUNICATIONS	TELCOR SA
FIDEL SÁNCHEZ	ENGINEER	PHD DEGREE THROUGH SIDA/SAREC	SIEMENS SA
RAUL CHANG TAM	EXECUTIVE SECRETARY	CONICYT OF GUATEMALA	CONICYT
VICTOR CASTAÑEDA	PRODUCTION DIRECTOR	TKL DEGREE THROUGH SIDA/SAREC	CAFE SOLUBLE SA

12.2. Contacted or Interviewed Personnel in Sweden and Swedish Embassy

NAME	POSITION	INSTITUTION/OFFICE	PLACE
CATHARINA WESSELING	PROFESSOR	UNA COSTA RICA/KAROLINSKA INST.	COSTA RICA
ANDREJ WIENRAUB	PROFESSOR	HUDDINGE UNIVERSITY HOSPITAL	HUDINGGE
ANN-KATRINE PALGREN	PROJECT PARTICIPANT	HUDDINGE UNIVERSITY HOSPITAL	HUDINGGE
BENGT MANDERSSON	PROFESSOR	LUND INSTITUTE OF TECHNOLOGY	LUND
CARINA KÄLLESTÅL	PROFESSOR	LUND UNIVERSITY	LUND
GORAN BENGTSSON	PROJECT PARTICIPANT	LUND UNIVERSITY	LUND
GÖRAN BENGTSSON	PROFESSOR	LUND UNIVERSITY	LUND
KJERSTIN DAHLBROUM	PROJECT PARTICIPANT	LUND UNIVERSITY	LUND
LARS DAHLGREN	PROFESSOR	LUND UNIVERSITY	LUND
LARS-ANDERS HANSSON	PROJECT PARTICIPANT	LUND UNIVERSITY	LUND
LEIF BJELMDEPT	PROFESSOR	LUND UNIVERSITY	LUND
PETER JONSSON	PROJECT PARTICIPANT	LUND UNIVERSITY	LUND
STAFFAN BERGLUND	PROFESSOR	LUND UNIVERSITY	LUND
STIG WALL	PROFESSOR	LUND UNIVERSITY	LUND
TIM GILES	SAREC PROG. COORD.	LUND UNIVERSITY	LUND
TORLEIF DAHLIN	PROJECT PARTICIPANT	LUND UNIVERSITY	LUND
TORSTEN CEGRELL	PROFESSOR	ROYAL INSTITUTE OF TECHNOLOGY	LUND
BJÖRN FROSTELL	FIRST SECRETARY	SWEDISH EMBASSY	MANAGUA
KLAS MARKENSTEN	AMBASSADOR	SWEDISH EMBASSY	MANAGUA
TORSTEN WETTERBLADH	FIRST SECRETARY	SWEDISH EMBASSY	MANAGUA
ANITA SANDSTR PN	HEAD OF DIVISION	SIDA/SAREC	STOCKHOLM
ANN KATRINE PALMGREN	PROFESSOR	KAROLINSKA INSTITUTE	STOCKHOLM
CECILIA SHARP	NICARG. CCORDINATOR	SIDA/SAREC	STOCKHOLM
EVERT LINDER	PROJECT PARTICIPANT	SMI/IMPI	STOCKHOLM
HANS HALLANDER	PROFFSSOR	SMI/IMPI	STOCKHOLM
INGVAR LUNDBERG	PROFESSOR	KAROLINSKA INSTITUTE	STOCKHOLM
JOAQUIN MARTINEZ	PROJECT PARTICIPANT	ROYAL INSTITUTE OF TECHNOLOGY	STOCKHOLM
KARE BONDESON	PROJECT PARTICIPANT	SMI/IMPI	STOCKHOLM
MAJ RINGMAN	PROJECT PARTICIPANT	SMI/IMPI	STOCKHOLM
MARIA TERESA BEJARANO	NICARG. COORDINATOR	SIDA/SAREC	STOCKHOLM
PATRICIA COLQUE	PROJECT PARTICIPANT	SMI/IMPI	STOCKHOLM
RONALD MOLBY	PROFESSOR	KAROLINSKA INSTITUTE	STOCKHOLM
TIM GILES	PROJECT PARTICIPANT	ROYAL INSTITUTE OF TECHNOLOGY	STOCKHOLM
TORSTEN CEGRELL	PROJECT PARTICIPANT	ROYAL INSTITUTE OF TECHNOLOGY	STOCKHOLM

BO MATTIASSON	PROJECT PARTICIPANT	SLU	UPPSALA
HENRIK ECKERSTEN	ASSOCIATE PROFESSOR	SLU	UPPSALA
JARI VALKONEN	ASSOCIATE PROFESSOR	SLU	UPPSALA
LARS ANDERSSON	PROJECT PARTICIPANT	SLU	UPPSALA
LARS OHLANDER	PROFESSOR	SLU	UPPSALA
MARIE NYMAN	PROJECT PARTICIPANT	SLU	UPPSALA

12.3. Assistance to the general meeting in Nicaragua on February 22, 2002

NAME	INSTITUTION
ANITA SANDSTRON	ASDI-SAREC
CECILIA SHARP	ASDI-SAREC
EDGARDO MORENO	ASDI-SAREC
MARIA TERESA BEJARANO	ASDI-SAREC
THOMAS ALVETEG	ASDI-SAREC
GUSTAVO CASTRO	BICU
MARITZA ESPINOZA	CIRA
MARIANO JOSE VARGAS	CNU
FAUSTO MUNOZ	EAG-ESTELI
MARTIN JIMENEZ	EIAG-RIVAS
GERARDO SILVA	INETER
JOSE RENE GASTEAZORO	PRODUCTOR
MARIANO VARGAS	ST-CNU
BJORN FROSTELL	SWEDISH EMBASSY
DAVID OROZCO GONZALEZ	UCA
ALBERTO SEILES JAEN	UNA
FREDDY ALEMAN	UNA
JIMMY HUECK ESPINO	UNA
MARGARITA CUADRA	UNA
SANDRA LOVO	UNA
TELEMACO TALAVERA (RECTOR)	UNA
VICTOR AGUILAR	UNA
MARIO RAMÓN LÓPEZ	UNAN-CINET
KJERSTIN DANLBHOM	UNAN-LEON
SALVADOR ROSALES	UNAN-LEON
AURORA ARAGÓN	UNAN-LEON
EDMUNDO TORRES	UNAN-LEON
EMER CISNEROS	UNAN-LEON
ERICK AMAYO	UNAN-LEON
ERNESTO MEDINA (RECTOR)	UNAN-LEON
FRANCISCO GUZMAN	UNAN-LEON
JORGE ALEMAN	UNAN-LEON
MARGARITA PANIAGUA	UNAN-LEON
RODOLFO PENA	UNAN-LEON
TRINIDAD CALDERA	UNAN-LEON
CHARLES WALLACE	UNAN-MANAGUA
DIONISIO RODRIGUEZ	UNAN-MANAGUA
FRANCISCO GUZMÁN (RECTOR)	UNAN-MANAGUA

OTONIEL ARGUELLO	UNAN-MANAGUA
RAINER PARRALES	UNAN-MANAGUA
JULIO CESAR TRAÑA	UNAN-MANAGUA
MARIO JIMENEZ	UNAN-MANAGUA.
ANA ULMOS VADO	UNI
FREDDY MARIN SERRANO	UNI
LEONEL PLAZAOLA	UNI
MARCIA VARGAS	UNI
MARIO CALDERA (RECTOR)	UNI
MARVIN SANCHEZ	UNI
RAFAEL GAMERO	UNI
MARGARITA GUEVARA	UPOLI
AMANDA PUHIERA	URACCAN

12.4. Acronyms Used

CA	CENTRAL AMERICA
CA-KIRT	GRADUATE PROGRAM IN BIOMEDICAL SCIENCES BETWEEN THE CENTRAL AMERICAN UNIVERSITIES AND THE KAROLINSKA INSTITUTE
CENIDA	UNA LIBRARY
CIEMA	CENTRE FOR STUDIES AND RESEARCH IN ENVIRONMENTAL SCIENCES
CIGEO	GEOSCIENTIFIC RESEARCH CENTER
CIRA	AQUATIC RESEARCH CENTRE
CISE	CENTRO DE INVESTIGACIONES SOCIALES Y EDUCACION
CNU	NATIONAL COUNCIL FOR UNIVERSITIES
COSUDE	NATIONAL COUNCIL FOR DISASTERS
CSUCA	COUNCIL OF CENTRAL AMERICAN UNIVERSITIES
DGA-MIDINRA	GENERAL DIRECTORATE OF AGRICULTURE OF THE MINISTRY OF AGRICULTURE
FAITAN	COMPETITIVE FUNDS FOR INVESTIGATION AND TECHNOLOGY TRANSFER
FCCA	FACULTY OF AGRICULTURAL SCIENCES AND LIVESTOCK OF UNAN
FEC	FACULTY OF ELECTRICAL AND COMPUTING ENGINEERING
FIQ	FACULTY OF CHEMICAL ENGINEERING
HEODRA	LEON CENTRAL HOSPITAL
IFS	INTERNATIONAL FOUNDATION FOR SCIENCE
ISI	INSTITUTE FOR SCIENTIFIC INFORMATION
KI	KAROLINSKA INSTITUTE
KTH	ROYAL INSTITUTE OF TECHNOLOGY
LA	LATIN AMERICA
MINSA	NICARAGUAN MINISTRY OF HEALTH
NETROPICA	NETWORK FOR RESEARCH AND TRAINING IN TROPICAL DISEASES IN CENTRAL AMERICA
NGO	NON-GOVERNMENTAL ORGANIZATION
NUFFIC	THE NETHERLANDS UNIVERSITY FOUNDATION FOR INTERNATIONAL COOPERATION
PIDMA	ENVIRONMENTAL ENGINEERING MASTERS PROGRAMME
SAREC	DEPARTMENT FOR RESEARCH COOPERATION AT SIDA
SIDA	SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
SLU	SWEDISH UNIVERSITY OF AGRICULTURAL SCIENCES, UPPSALA
SMI	SWEDISH INSTITUTE FOR INFECTIOUS DISEASE CONTROL
TU DELFT	THE DELFT TECHNICAL UNIVERSITY, THE NETHERLANDS
TWAS	THIRD WORLD ACADEMY OF SCIENCES
UMFM	UNAN-MANAGUA FACULTY OF MEDICINE
UNA	NATIONAL UNIVERSITY OF AGRICULTURE
UNAN	AUTONOMOUS NATIONAL UNIVERSITY OF NICARAGUA
UNAN-LÉON	NATIONAL AUTONOMOUS UNIVERSITY OF NICARAGUA, LÉON
UNAN-MANAGUA	NATIONAL AUTONOMOUS UNIVERSITY OF NICARAGUA, MANAGUA
UNI	NATIONAL UNIVERSITY OF ENGINEERING

UNI	NATIONAL UNIVERSITY OF ENGINEERING
UPOLI	UNIVERSITY OF POLYTECHNICS
WHO	WORLD HEALTH ORGANIZATION

12.5. Terms of reference

Evaluation

Future Direction of the Research Cooperation between Nicaragua and Sweden

12.5.1. – Background

The research cooperation with Nicaragua has been going on for almost twenty years. One important characteristic of the research cooperation is its long-term nature implying that most initiated programs are still running. Sida's policies and objectives for research cooperation have developed over time. The means of implementation to reach the objectives have changed as well. Three main phases can be identified in Sida's approach. At its initiation the co-operation was project oriented dealing with important research issues where new knowledge was needed. Focus was on solving problems and only little competence was built in Nicaragua. With time the co-operation came to focus on research training through the "Sandwich Model". The idea with the "Sandwich model" is to build on layers, the student spends 3–6 month a year at a co-operating department taking courses, supervision and perform research while the rest of the year is spent at the home university doing research and participate in teaching at the University. This study model was partly developed as a means to avoid so-called "brain drain" from Universities in the South through the continuous contact with the home institution. The model is also a means to identify and carry out research relevant to Nicaragua.

Today the Swedish research co-operation with Nicaraguan Universities aims primarily at strengthening research and research capacity at selected faculties as a vital part of a comprehensive knowledge system. The overall objective is to contribute to a vitalisation and modernisation of the university system. The competence of university lectures and the quality of university teaching are enhanced through research training and produces the researchers and lecturers needed in the country. Additionally, these persons acquire competence to identify, analyse and find solutions to the country's own development problems.

The co-operation comprises research programmes with the two big National Universities (UNAN-Managua and UNAN-León) and the agricultural and engineering sector universities (UNA and UNI). The programme portfolio contains a variety of projects and has developed over time. Research programmes are today focused to four main areas viz.: health, natural resources and agriculture, engineering and environment. In addition support is provided to the National Council for Universities (CNU) for joint activities promoting the reformation of the university system. The main components of the co-operation are research training of university lecturers, library support, support to equipment and laboratories needed to create viable research environments and support for improved research administration and management. The support is tailored to the needs of the specific university in question. Presently some fifty persons are enrolled in research training at departments at various universities in Sweden and in some cases in other countries.

In November 2001 Sida's Research Council took a decision for a continued three-year support amounting at a total of 82 milj SEK (22 milj/2001, 30 milj/2002, 30 milj/2003). It was also decided to carry out an evaluation of the whole co-operation to make use of past experiences to form the new co-operation. A supplementary study on the Nicaraguan system for higher education will follow the evaluation.

Detailed budgets have been agreed with the universities for 2001. For 2002 and 2003 budgets have been framed at university level. This evaluation can give an input to the division of resources between the programmes already during this agreement period.

12.5.2.– Purpose and Scope of the Evaluation

The overarching objective of the evaluation is to give guidance on the future direction of the research cooperation and means for its implementation with the purpose of making the cooperation more sustainable and efficient. The evaluation shall be based on participatory methods to strengthen the local initiative and ownership of the programmes.

Former evaluations of the research cooperation with Nicaragua have been carried out project wise reference is made to: SAREC support to research in health sciences at the UNAN-León, Nicaragua, (Allebeck and Nieto, 1994) Evaluation of the SAREC supported research project in geosciences in Nicaragua 81-93 (Gaál, 1994) Evaluation of the Nicaraguan-Swedish Research cooperation under the agreement between UNI and SAREC, (Lieberknecht, 1994). Studies on aspects of the Nicaraguan university system has also been carried out (Brunner and Eduards, 1994, Rojas and Dahlgren, 1998).

The focus of this evaluation is to analyze and elucidate past achievements, results and experiences and based on this formulate ideas on the future nature of the whole research cooperation.

Attention shall be paid to the process of identifying joint objectives for the cooperation. The process of formulating objectives shall elucidate the various levels of the cooperation from the project specific, to the university level and the national level.

Findings from the evaluation should be used in the process of identifying the size, components and the direction of the future cooperation both at a local level and at Sida.

12.5.3.– The Assignment

The evaluation shall specifically analyze the following aspects of the cooperation:

– Objectives, relevance and resources

To what extent, at a general level, have the support to the four universities (UNAN-León, UNAN-Managua, UNA and UNI) reached the general objectives of the reserach cooperation between Sweden and Nicaragua.

Analyze the present situation of **resources for research** at the participating universities – availabel human resources, reserach environments, infrastructure, ICT-facilities and potentials for funding including national and international sources. – In what way have the cooperation contributed to the situation? What will be the situation in five years and in ten years? What will be the role of Sida in the same time perspective? Other donors?

Analyze and describe existing mechanisms for setting the research **priorities** at the university level and at a national level. Describe the main areas for current research and the relevance of current research to the development of the country in light of the aim to reduce poverty. To what extent is this reflected in the present cooperation with Sweden?

Describe and initiate a process to identify present **objectives** with the cooperation at project level, university level and national level, how shall objectives be set, quantitative and qualitative.

Describe present strategies for research and research training at the participating universities and in the country.

Analyze the present status and role of research at the participating universities and in the country and in five and ten years.

To what extent have the support contributed to the present modernisation and reformation processes of the universities participating in the cooperation.

Is the present size and content of the cooperation adequate, what changes would benefit the cooperation? Describe a **vision** of how the cooperation will look like in five years and in ten years?

– Institutional/administrative and management aspects

Describe the present **research management** at the university and assess possible bottlenecks.

Assess to what extent the research cooperation has contributed to improved research management

– Aspects of strengthening of research capacity

Analyze and describe the **past achievements** in the cooperation, number of students enrolled, general progress and number of graduated MSc and Ph.D. students. To what extent has research capacity been built? What have been the opportunities and bottlenecks of the cooperation (i.e. quantitative and qualitative experiences).

Assess to what extent the support has contributed to viable **research environments**.

Assess to what extent the programmes have contributed to a “**critical mass**” of competent researchers in specific areas. To what extent is the program vital on its own, issues of sustainability. How can this be improved? Give suggestions of improved means of cooperation.

Analyze the **interaction** with the Swedish counterpart. What is the present role of the Swedish counterpart in the cooperation. Discuss roles, issues of dependency, ownership, commitment, objectives, issues of leadership. How can the cooperation be strengthened and be more clear.

12.5.4.– Methodology, Evaluation Team and Time Schedule

The evaluation team shall consist of three members viz. Lea Vehlo, Thomas Alveteg and Edgardo Moreno. Lea Velho has been appointed team leader. As a group the team has broad experiences in research and higher education, institutional co-operation and are also familiar with development issues. The members of the team represent different academic disciplines and has accordingly sector specific responsibilities within the team. Lea Velho will have the overall responsibility to lead the evaluation and specifically evaluate the cooperation with UNA in natural resources and agriculture, Edgardo Moreno will particularly evaluate the health co-operation with León and with UNAN-Managua and Thomas Alveteg will evaluate the engineering co-operation with UNI and the environmental programme with UNAN-Managua. The Team leader has the responsibility to lead the evaluation and to conclude the final document to Sida.

The evaluation comprise a total of 24,5 weeks (LV 10v, TA 7,5v and EM 7v)

Prior to the initiation of the evaluation Sida shall brief the consultants at a meeting at Sida in Stockholm in May. Sida shall provide necessary information and documentation to the evaluators about the programmes. The consultants shall develop a program/plan including adopted methods for the evaluation to be presented to Sida before the mission in Nicaragua.

Information and experiences shall also be gathered from other relevant parties e.g. Swedish Embassy in Nicaragua other donors (World Bank, IDB), Consejo Nacional de Universidades (CNU) and others.

The team shall carry out **interviews** with key persons both in Nicaragua and Sweden and facilitate a **process with active participation** of the different actors/stakeholders. Preferably by organising workshops or similar activities in Nicaragua which activates the stakeholders.

The team shall visit Nicaragua 7-14 days during May to end of July. In Nicaragua a joint **workshop** with representatives from all universities and CNU shall be arranged to state the mission. This workshop shall be followed by university specific evaluation activities.

The draft findings shall be presented to relevant stakeholders in Sweden and Nicaragua and be discussed at a workshop in Nicaragua in September/October with participation of some Swedish key counterparts and Sida. The date of the workshop has to be decided together with Sida.

The Consultancy firm AKKADIA is responsible for the administration of the evaluation. Contact persons at the various universities for local coordination have been appointed. Rafael Gamero at UNI has been appointed local co-ordinator of general nature for the evaluation. Contact details:

Rafael Gamero, Coordinator, UNI, Gameraf@yahoo.com or rafaelg@ket.kth.se

Edmundo Torres Vice Rector UNAN-León, etorres@unanleon.edu.ni

Freddy Aleman, Director Research Direction, UNA, freddy@ibw.com.ni or psuna@tmx.com.ni

Dionision Rodrigues, Coordinator, UNAN-Managua, Cigeo@cablenet.com.ni

12.5.5.– Reporting

– Seminar arranged by Sida as part of the overall evaluation assignment

The evaluation report shall be written in English with a summary in Spanish. Format and outline of the report shall follow the guidelines in Sida Evaluation Report - a Standardised Format (see Annex 1). 6 copies of the **draft report** shall be submitted to Sida no later than **September 7, 2001**. One copy of the draft report shall also be distributed to each university participating in the evaluation no later than **September 7, 2001**. The draft report shall be presented for comments at a **workshop in Nicaragua** in late **October or early November** with participation of representatives from the Nicaraguan universities, the Swedish counterparts and Sida. Within **3 weeks** after the workshop a **final version** shall be submitted to Sida in 6 copies and on diskette. A **presentation** of the final conclusions shall be carried out **at Sida in November**. The final report shall be translated into Spanish by Sida.

Subject to decision by Sida, the report will be published and distributed as a publication within the Sida Evaluations series. The evaluation report shall be written in Word 6.0 for Windows (or in a compatible format) and should be presented in a way that enables publication without further editing. The report shall begin with an Executive Summary and close with a selection of Conclusions and Recommendations.

– Remuneration and travel costs.

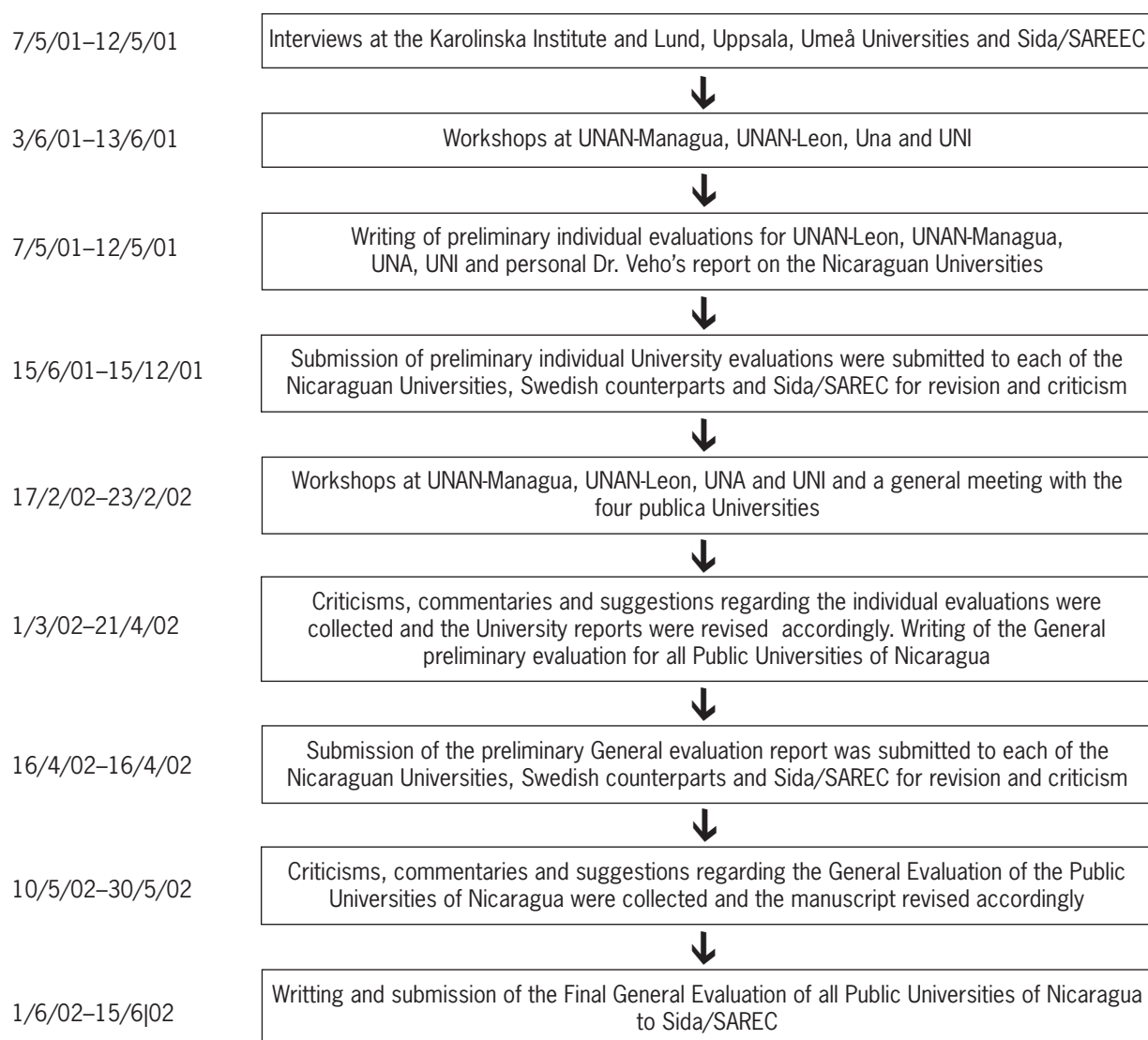
These are agreed and set out in a separate contract. The consultants shall make their own travel arrangements.

– Enclosures

Sida Evaluation Report – a Standardised Format, Sida's Evaluation Policy

12.6

Flow sheet of the general evaluation plan



12.7. General situation of the public Nicaraguan Universities

12.7.1. Number of public and private Nicaraguan Universities, professional careers and number of students from 1958 to 2000

1958

Number of Universities *	1
Number of University careers	5
Number of students	956

2000

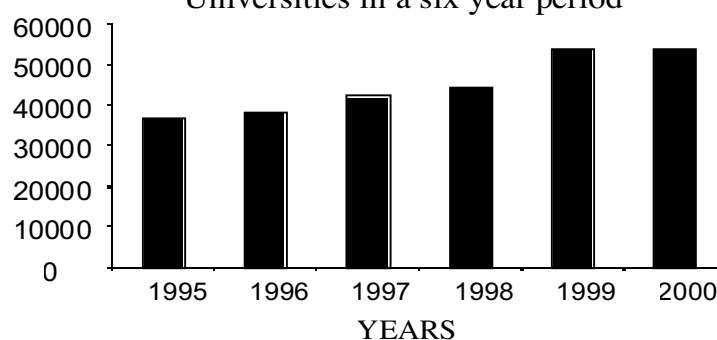
Number of Universities *	34
Number of University careers	>100
Number of students 956	85113**

* Includes Technical Centers for Education

** Number of students between 18 and 24 year old = 713746, rate close to 12 %

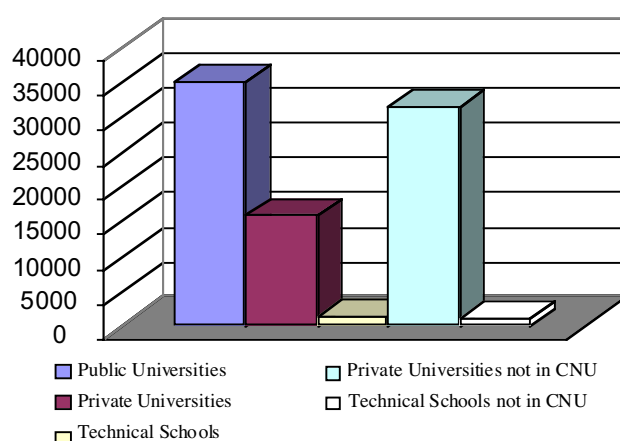
12.7.2

Number of Freshman Students in Nicaraguan Universities in a six year period

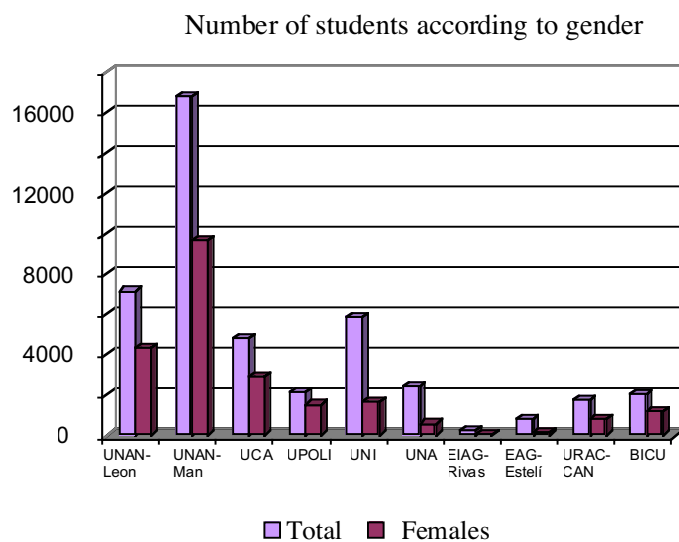


12.7.3

Number of students in the various Nicaraguan Universities in 2000

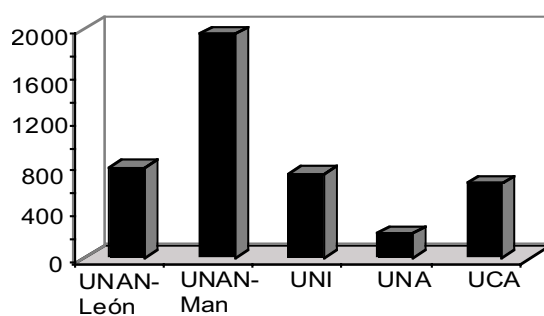


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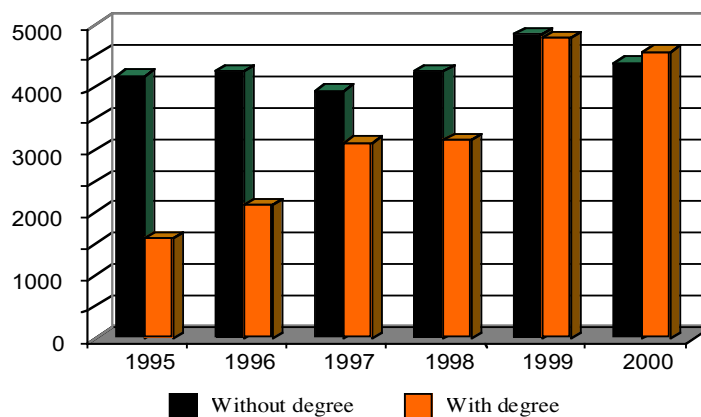
12.7.5

Total Number of student at the Nicaraguan Universities 2001



12.7.6

Number of students that have concluded University studies in six-year period



12.7.7. Relative number of students according to the academic level at the Public Universities of Nicaragua

Academic degree to be obtained	Percentage
Technical degree (< than 3 years)	6.77
Bachelor-Licenciature (4-5 years)	91.66
Master degree (1-2 years)	1.55
Ph.D.	0

12.7.8. Relative number of students according to discipline at the Public Universities of Nicaragua

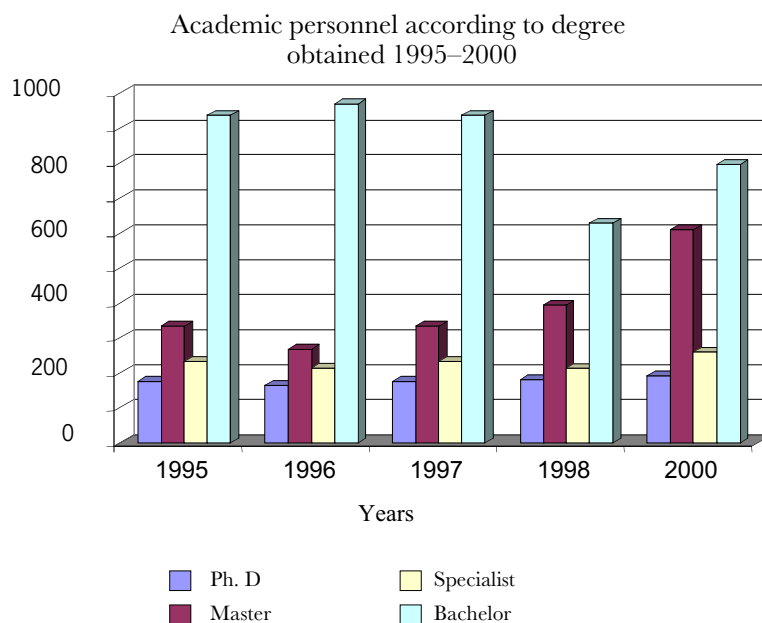
Discipline	Percentage
Natural Sciences	7.0
Engineering and Technology	17.24
Education	17.23
Economy and Social Sciences	21.8
Humanities and art	5.9

12.7.9. Relative distribution of students and inhabitants* for geographical region in Nicaragua

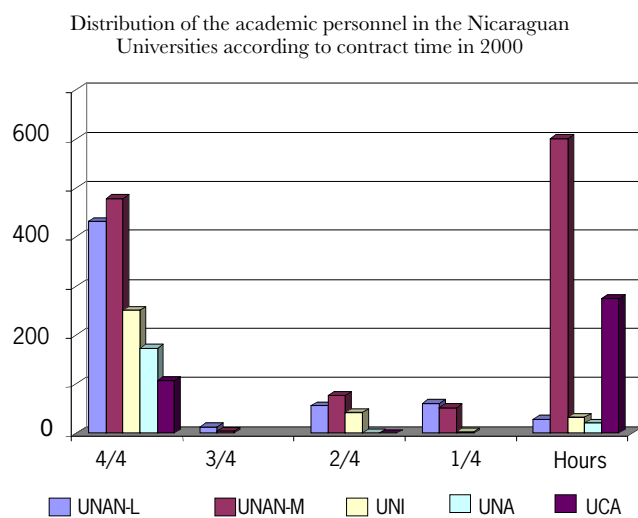
Region	Category	Percentage
Pacific (Managua)	Students	75.9
	Inhabitants	56.06
Central-Northern	Students	19.4
	Inhabitants	31.24
Caribbean coast and San Juan River	Students	4.72
	Inhabitants	12.69

– Total number of inhabitants in Nicaragua = 5 000 000

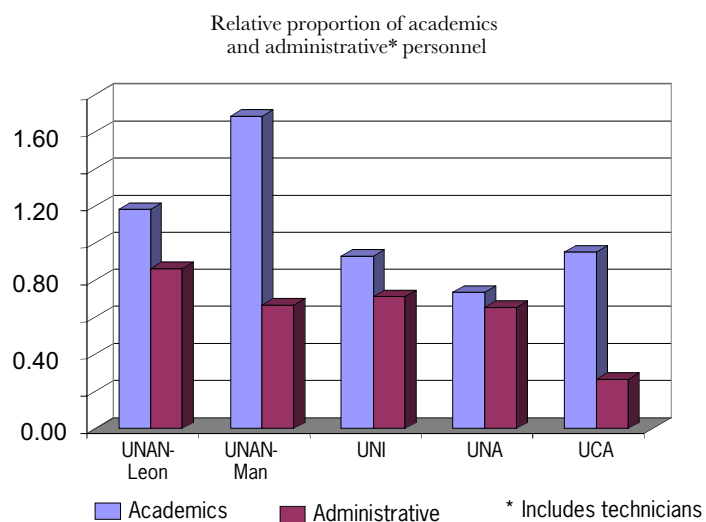
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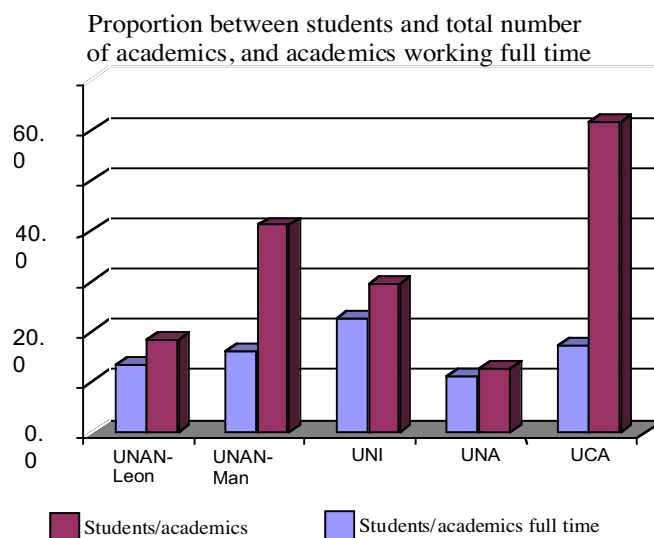
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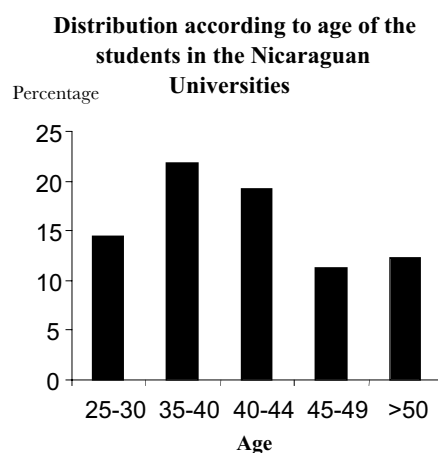
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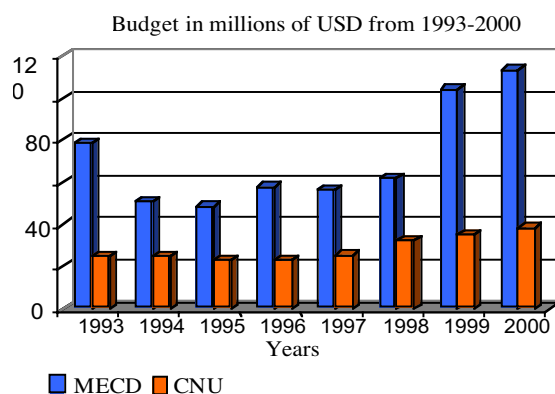
12.7.13



12.7.14

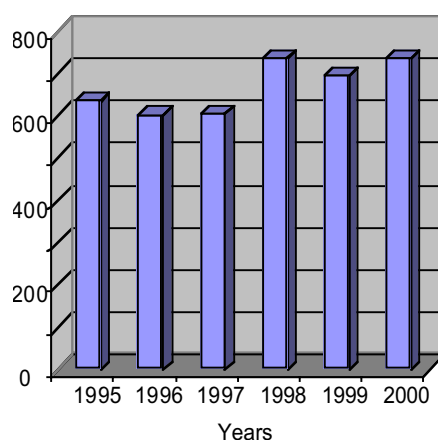


12.7.15



12.7.16

Annual cost in USD per student at the public Universities of Nicaragua



12.7.17. Table 1. Comparison of the social and economical development of the CA countries

Country	Illiteracy rate %	Children life expectancy*	GIP per capita	Development index among 162 countries	Average GIP % 1997–2000	Education investment % of GIP
Costa Rica	4.8	9.0	8.9	41	6.5	5.9
Panamá	8.9	8.0	5.9	52	3.6	5.0
Belize	15.4	6.0	5.0	54	5.0	2.5
El Salvador	23.0	6.0	4.3	95	3.2	2.5
Nicaragua	36.6	3.0	2.3	106	5.5	4.0
Guatemala	33.4	4.0	3.7	108	4.1	1.7
Honduras	29.3	5.0	2.3	107	2.7	3.0

*Expressed as [1000 – children survival up to 5 years of age per 1000 live births]/10.

For comparison purposes, Costa Rica indexes are similar to those of Chile but above Mexico and Brazil. Source: UNESCO, annual statistics 1997–2000.

12.8. General Situation of UNAN-Leon

12.8.1. Table 1. If you have carried out studies in a foreign country please answer the questions.

a) Did you require English language during your training?	None 4.3%	Moderately 21.7%	A lot 74%	No response 0%
b) Did you have problems with English language during your studies?	Many 13%	Moderately 43.5%	None 43.5%	No response 0%
c) Did you like your research project?	Little/none 4.3%	Moderately 0%	A lot 91.4%	No response 4.3%
d) Was your stay abroad useful for you?	Little 0%	Moderately 0%	A lot 100%	No response 0%
e) Do you still work in the same subject of your thesis?	Little/no 8.7%	Some times 17.3%	Frequently 74%	No response 0%
f) Do you still collaborate with your tutor?	Little/none 21.7%	Some times 30.4%	Frequently 47.9%	No response 0%
g) Did you have academic problems during your training?	A lot 0%	Moderately 26%	Little/none 74%	No response 0%
h) Have you applied what you have learned in your training?	Little/none 4.3%	Moderately 8.7%	A lot 87%	No response 0%
i) Have you taught what you learned in your training?	Little/none 4.3%	Moderately 21.7%	A lot 74%	No response 0%
j) During your training, the collaboration environment was	Bad 0%	Moderately 4.3%	Good 91.4%	No response 4.3%
k) Was your tutor well versed in his/her specialty?	Little 4.3%	Moderately 17.4%	Very much 74%	No response 4.3%
l) Did you have economical problems during your training?	A lot 4.3%	Moderately 47.8%	None 43.5%	No response 4.3%

N = 26 questionnaires

12.8.2. Table 2. If some questions do not apply to you, live them without mark.

a) Time devoted to teaching	less 25% 40%	25%-50% 34%	more 50% 22%	No response 4%
b) Time devoted to research	less 25% 31%	25%-50% 40%	more 50% 25%	No response 4%
c) Time devoted to administration	less 25% 51.5%	25%-50% 11.5%	more 50% 14%	No response 23%
d) Do you like your work?	Little/none 0%	Moderately 8.5%	A lot 91.5%	No response 0%
e) You are hired for	<_ time 5%	_ time 11%	>_ time 80%	No response 4%
f) Is your salary adequate for the work you perform?	Low 74%	Moderate 14%	Adequate 4%	No response 9%
g) Do you have another job?	Yes 20%	Some times 20%	No 54%	No response 6%
h) Do you have help from a technician?	Yes 40%	Some times 23%	Never 28.5%	No response 8.5%
i) Do you collaborate with other Departments?	Little 11.5%	Some times 66%	Regularly 14%	No response 8.5%
j) Do you collaborate with other Nicaraguan Universities?	Little 57%	Some times 22.5%	Regularly 6.5%	No response 14%
k) Do you collaborate with your colleagues?	Little 0%	Some times 25%	Regularly 71%	No response 4%
l) Do you collaborate with foreign institutions?	Little 25.5%	Some times 34.5%	Regularly 23%	No response 17%
m) Do you have national grants?	< \$100 86%	\$100-\$1000 4%	\$1000 5%	No response 5%
n) Do you have international grants?	< \$ 500 86%	\$500-\$3000 11.5%	\$ 3000 31.5%	No response 8%
o) The physical facilities of you working place are	Poor 17%	Regular 57%	Good 17%	No response 9%
p) The laboratory facilities are:	Poor 5.7%	Regular 57%	Good 11.5%	No response 25.5%
q) The teaching facilities are:	Poor 17%	Regular 54%	Good 23%	No response 6%
r) Do you have access to computers?	Little/never 6%	Some times 14%	Always 80%	No response 0%
s) Do you have access to E-mail and Internet?	Little/never 8%	Some times 28%	Always 60%	No response 4%
t) Do you find what are you looking for at the library?	Rarely 31.5%	Some times 48.5%	Always 8.5%	No response 11.5%
u) Do you work alone?	Always 4%	Some times 40%	Rarely 45%	No response 11%
v) Do you speak English	Poorly 25.5%	Moderately 48.5%	Well 23%	No response 3%
w) The library service is	Poor 6%	Regular 57%	Good 25.5%	No response 11.5%

x) The purchasing services at UNAN are	Poor 31.5%	Regular 23%	Good 0%	No response 45.5%
y) The management of funds for research is	Poor 11.5%	Regular 48.5%	Good 6%	No response 34%
z) Do you take courses for upgrading your knowledge?	Rarely 20%	Some times 40%	Commonly 23%	No response 17%
aa) Do you assist to symposia or training courses abroad?	Rarely 31.5%	Some times 45.5%	Commonly 23%	No response 0%

N = 49 questionnaires

12.8.3. Table 3. Number of publications at the different UNAN-Leon research projects.

Research Project	Congresses and National publications*	International	Total
Reproductive Health	8	16	24
Mental Health	0	14	14
Occupational Health	16	15	31
Infant Diarrhea	10	5	15
Parasitic infection	5	6	11
Antimicrobial resistance	1	5	6
Bacterial antigens	10	7	17
Total	50	67	118**

*Mainly in the form of Congresses and Symposia

** Close to 80 % of the publications have been produced in the last decade, and close to 50 % in the last 5 years

12.8.4. Table 4. UNAN-Leon Research Projects in Biomedical Sciences and Public Health

-
- Antibiotic resistance
 - Infant diarrhea
 - Diagnosis and risk factors of *Toxoplasma Gondii*
 - Chagas disease
 - Parasitic intestinal diseases
 - Cisticercosis monitoring
 - Purification and characterization of biological material
 - Epidemiology and public health
 - Infant mortality and social disparity in Nicaragua
 - Domestic violence and its impact in public health
 - Suicidal behavior and its implications in public health
 - Sexual transmitted diseases and VIH infection
 - Traumas and lesions in the Municipality of Leon
 - Neurophysiological actions of plaguicides in farm workers
 - Dermal exposure to plaguicides
 - Occupational risk factors and respiratory diseases
 - Lead intoxication.
-

12.8.5

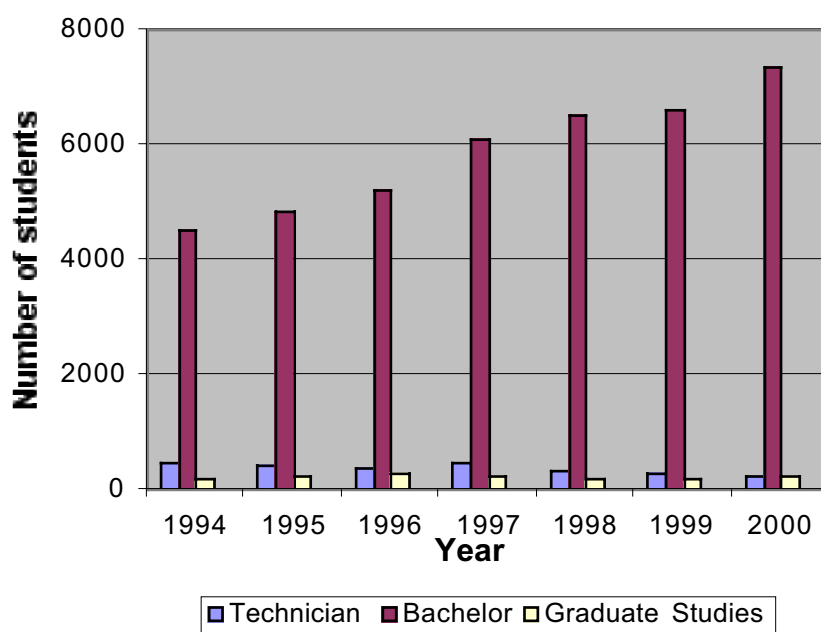


Fig 1. Number of UNAN-Leon students according to the training level in the last 7 years

12.8.6

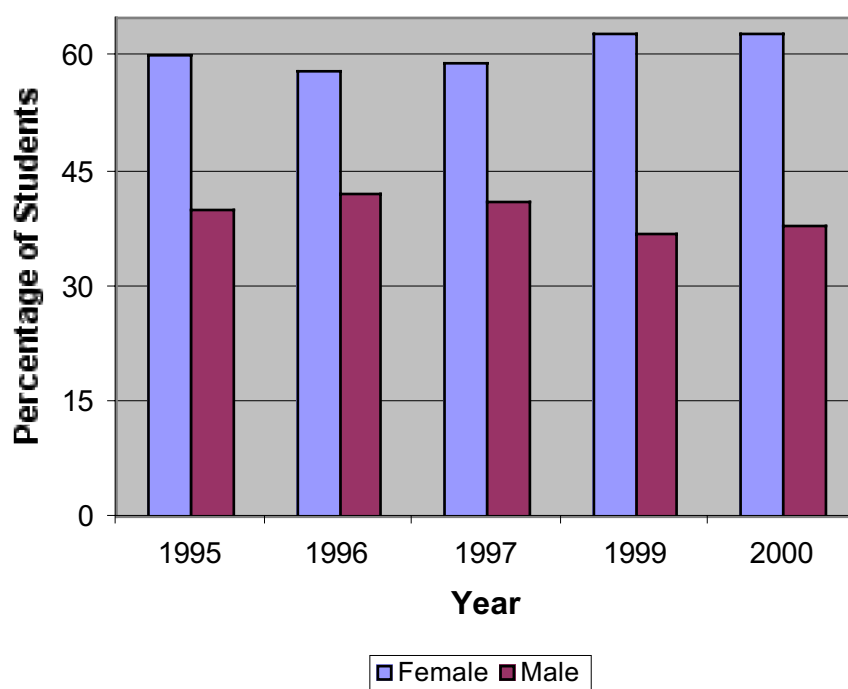


Fig 2. Percentage of UNAN-Leon students according to sex in the last 5 years

12.8.7

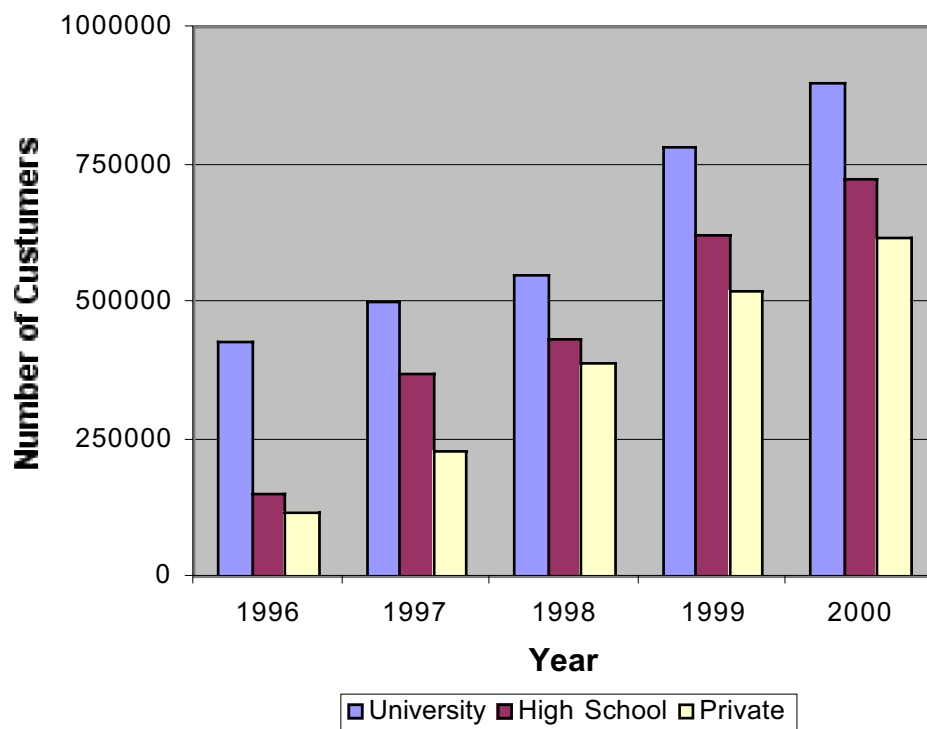


Fig 3. Number and category of UNAN-Leon library customers in the last 5 years

12.8.8

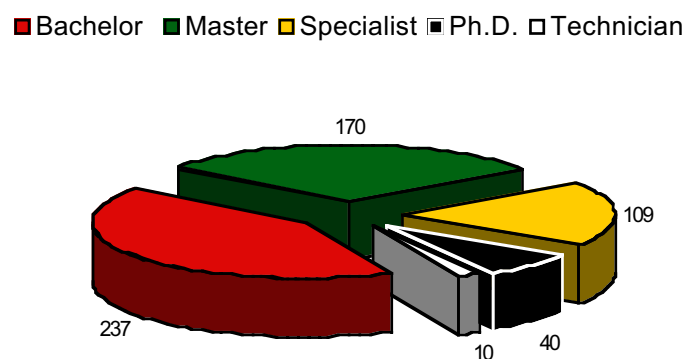


Fig. 4 Distribution of the UNAN-Leon academic personnel according to the degree obtained

12.8.9

■ Full time ■ 3/4 time ■ 1/2 time ■ 1/3 time ■ 1/4 time □ < 1/4 time

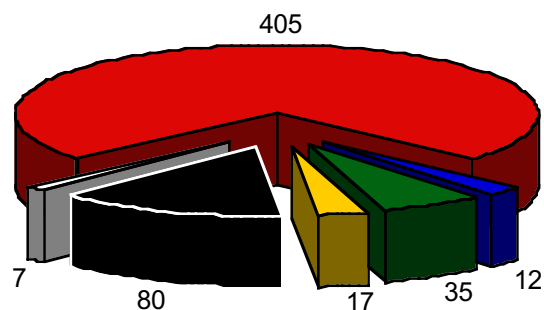


Fig. 5 Distribution of the UNAN-Leon academic personnel according to contract time

12.8.10

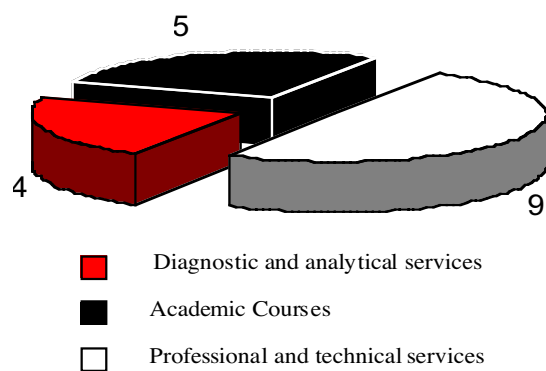


Fig. 6. Number and category of external services offered by UNAN-Leon

12.8.11. Recommendations given by UNAN-Leon

12.8.11.1. A la UNAN-Leon a corto plazo

- Establecer el marco normativo de la actividad investigativa, de tal forma que se institucionalicen políticas claras de investigación que aseguren la sostenibilidad de esta función universitaria. Lo anterior implica, entre otras cosas, el cumplimiento de las siguientes tareas: definir la organización estructural y funcional de la investigación; crear las estructuras necesarias, en todos los niveles de la institución, para alcanzar la eficiencia en la gerencia y monitoreo de las actividades de investigación; reglamentar y regular la actividad investigativa; adecuar, definir e incorporar el trabajo investigativo como parte de las funciones del académico, con todas las implicaciones administrativas que esto conlleva; incluir en la base de las normas el aseguramiento de las condiciones óptimas para la investigación y el cumplimiento de las expectativas de los investigadores y la Universidad; definir una estrategia de evaluación de la actividad investigativa que permita identificar el grado de progreso de la misma, con el consiguiente reconocimiento y estímulo a los investigadores.
- Identificar las prioridades en investigación, /o cual, en el contexto de la UNAN-Leon, significa definir los problemas y necesidades de la sociedad a cuya solución esta institución deberá contribuir.
- Crear un sistema de investigación que permita la organización de grupos multidisciplinarios capaces de consolidar las fortalezas existentes, de iniciar propuestas integradoras de investigación y de articular de manera coherente el desarrollo de las actividades investigativas, otorgándole un carácter de red al sistema.

12.8.11.2. A Asdi/SAREC, a corto plazo A CORTO PLAZO

- Consolidar el modelo de fortalecimiento de la capacidad de investigación de la Universidad mediante: a. la revisión exhaustiva del paradigma de formación de los investigadores; b. la definición de los parámetros de selección de los candidatos; c. El aseguramiento de la continuidad en el entrenamiento de recursos nuevos; d. La discusión compartida del análisis científico de las propuestas de cooperación; e. El apoyo a trabajos de investigación e intervención comunitaria que propicien la adquisición de competencias, mas que grados académicos; f. La admisión de programas de formación "triangulares" con terceros países, en áreas en donde las instituciones suecas no tengan la experiencia; g. La creación de un directorio de posibles tutores en Suecia, a fin de contactar a los mas calificados y dispuestos a colaborar; h. La realización anual de un evento científico conjunto entre las contrapartes nicaragüenses y suecas, dedicado a la presentación de los avances de la investigación; i. El establecimiento de regulaciones en el planteamiento de las necesidades de las contrapartes suecas; j. El seguimiento a la ejecución del presupuesto de las contrapartes suecas; k. El establecimiento, en conjunto con la UNAN- Leon, de un concepto claro del desarrollo institucional; l. la preparación del contenido de cooperación del próximo periodo durante el bienio 2002-03; m. La permanencia de los actuales oficiales de Asdi/SAREC encargados de la cooperación con las universidades nicaragüenses .
- Diversificar los mecanismos de cooperación mediante la inclusión de nuevas iniciativas, las cuales incluyan, por ejemplo, la creación de estructuras dirigidas a la prestación y venta de servicios, el apoyo al programa de jóvenes investigadores, la formación de recursos en cortos periodos y en áreas no necesariamente ligadas a los proyectos de investigación, pero si importantes para superar las brechas de conocimiento existentes entre los académicos, el fortalecimiento de redes locales, nacionales e internacionales en la búsqueda de solución a problemas comunes.
- Cooperar en la identificación del modelo apropiado de organización de la investigación en la UNAN-Leon, apoyando así la creación del sistema de investigación, el surtimiento de grupos multidisciplinarios y facilitando la interacción entre los investigadores.

12.8.11.3. A LA UNAN-Leon a largo plazo

- Replantear la organización y gestión de la universidad como un sistema que fortalezca la función de investigación, lo cual significa: a. Establecer, con la participación conjunta de investigadores y autoridades, una clara estrategia de desarrollo de la investigación para los próximos 10 años; b. Profundizar la reforma universitaria en el ámbito del ordenamiento del trabajo docente, de manera que se promueva e incentive la investigación; c. Establecer mecanismos de reconocimiento a /os investigadores, de acuerdo a su productividad y no a su estatus; d. Crear un sistema de incentivos para la labor de investigación; e. Crear los centros e institutos de investigación, concentrando y optimizando así /os recursos de investigación; f. Crear mecanismos de sostenibilidad financiera de la investigación; g. Establecer un sistema de monitoreo y evaluación institucional de la investigación; h. Consolidar el modelo de gestión de la investigación.
- Consolidar la función de investigación como parte del pensamiento estratégico de la institución, asegurando que la misma sea parte importante de la misión y los objetivos de la Universidad, y que, asimismo, se constituya en una actividad prioritaria en el currículo y los planes de la UNAN-Leon.
- Fortalecer las relaciones interinstitucionales en apoyo a la investigación, logrando la presencia de la UNAN-Leon en instituciones nacionales, extranjeras e internacionales para promover la transformación de la sociedad a partir de las experiencias investigativas, y dedicando esfuerzos a la formulación de proyectos conjuntos con la sociedad y el estado nicaragüense, todo lo anterior con el propósito de lograr el impacto y la sostenibilidad deseados.

12.8.11.4. A ASDI/SAREC, a largo plazo

- Trascender a una nueva etapa en el fortalecimiento de la capacidad de investigación, la cual se caracterice por: a. la creación de programas doctorales nicaragüenses; b. La creación de unidades conjuntas de investigación entre investigadores nicaragüenses y suecos; c. El fortalecimiento de la participación conjunta de los grupos nicaragüenses- suecos en redes temáticas internacionales; d. La inversión estratégica en proyectos de infraestructura investigativa; e. El apoyo a nuevos proyectos.
- Contribuir a la vinculación entre los programas de cooperación universitaria y los programas suecos de ayuda al desarrollo en otras instituciones, apoyando proyectos de base comunitaria con la participación de las universidades y promoviendo la colaboración entre las mismas.
- Asegurar la continuidad de la cooperación en base al seguimiento de las evaluaciones, el cumplimiento de los compromisos de las universidades y la definición de plazos de formación que ofrezcan estabilidad en el proceso de formación y la identificación de soluciones a /os problemas más sentidos del país.

12.9. General situation of UNAN-Managua

12.9.1. Recommendations given by UNAN-Managua

12.9.1.2.- Recomendaciones a corto plazo a la UNAN-Managua

- Definir una política de estímulo salarial y académica relacionada con la actividad de investigación (Presupuesto definido para investigación; estímulo por resultados y grados obtenidos).
- Proyección de actividades de investigación mediante la publicación extensiva de los trabajos que se realizan (reportes, trabajos monográficos, artículos, etc).
- Revisar el modelo organizativo de investigación de la institución, fortaleciendo los centros de investigación y facultades, estableciendo una política de interacción.

12.9.1.3. Recomendaciones a largo plazo a la UNAN-Managua

- Definir estrategias que den sostenibilidad a la investigación. 2. Fortalecer la creación del laboratorio central de investigación.
- Fortalecer la investigación multidisciplinaria a través de PMIA y ampliarlo

12.9.4. Recomendaciones a Asdi/SAREC a corto plazo

- Ampliar el presupuesto asignado a la UNAN – Managua, tomando en consideración que la cooperación con esta institución tiene poco tiempo en relación con otras instituciones para extender el programa a otras áreas, tales como: C. C. Económicas y Sociales, Educación y Humanidades.
- Consolidar la cooperación para la formación del laboratorio Central en la UNAN- Managua, fortaleciendo así la capacidad de investigación instalada.
- Ampliar el fondo abierto destinado a proyectos de investigación de corta duración para docentes – investigadores de las facultades y extensiones regionales universitarias.

12.9.5. Recomendaciones a Asdi/SAREC a largo plazo

- Establecer y dar seguimiento a una política de sostenimiento de los egresados del programa integrándoles en acciones de intercambio y actualización Científica Postdoctoral.
- Prolongar el PMIA (Programa Multidisciplinario de Investigación Ambiental) hasta formar al menos 4 generaciones de PhD.
- Fortalecer la relación Nicaragüense – Sueco estableciendo un programa de intercambio científico a través de cursos de postgrado, seminarios, congresos, etc, en Nicaragua.

12.10. General situation of UNA

12.10.1. Table 1. SAREC's Financial Support to UNA

	1998	1999	2000	2001
PhD support	2300 (53)	2900 (72)	3200 (94)	3400 (85)
Institutional Support	1150 (26)	530 (13)	200 (6)	300 (7.5)
Research Council	500 (11)	–	–	300 (7.5)
Curriculum Development	350 (8)	300 (7)	–	–
Monitoring and Evaluation	50 (1)	320 (8)	–	–
Total	4350	4050	3400	4000

Sources: Bilateral Research Cooperation with Nicaragua 1998–2000 (Appendix 2, ref.: BUDGMCE.XLS 1998-05-11 10.25) for 1998, 1999 and 2000; Asdi's Project Assessments and Budgets for the years 2001–2003 (Research Cooperation with National University Agriculture – pp. 1–3). Figures in brackets correspond to percentages of the total budget for the specific year

12.10.2. Table 2. UNA full-time Faculty Members, per Gender and Degree (2001)

	Female	Male	Total
Graduates	38 [60%]	35 [34%]	73 [44%]
Graduates on MSc Studies (UNA-SLU)	9 [14%] –	13 [13%] –	22 [13%] –
MSc (MSc UNA-SLU)	17 [26%] (1)	48 [48%] (16)	65 [39%] (17)
MSc on PhD Studies* (UNA-SLU)	3 (1)	9 (9)	12 (10)
PhDs (PhD UNA-SLU)	– –	5 [5%] (2)	5 [3%] (2)
Total	64	101	165

99Source: Lista de Docentes – Universidad Nacional Agraria – 2001

* This line does not add to the total. It is a subgroup of the MSc degree holders

12.10.3. Table 3 list of Ph.D students trained in the Sandwich modality at SLU and UNA.

Name of research student	Sex	Year training started*	Training abroad (Months)	Year for ph:D degree
1. Freddy Aleman	M	1995	7	2000**
2. Victor Aguilar	M	1995	7	2001**
3. Telemaco Talavera	M	1995	3	2002
4. Margarita Cuadra	F	1997	2	2002
5. Alberto Sediles	M	1998	2	2003
6. Guillermo Reyes	M	1998	6	2003
7. Aldo Rojas	M	1998	11	2003
8. Oscar Gomez	M	1998	7	2003
9. Francisco Salmeron	M	1998	3	2003
10. Nadir Reyes	M	2000	4	2005
11. Guillermo Castro	M	2000	5	2005
12. Benigno Gonzalez	M	2000	5	2005

* Does not take into account the MSc. training time

** Ph.D degree was granted in this year

12.10.4. Table 4. Number of publications in a 15 year period of collaboration between UNA and SLU*

Year	Presentation in Symposia	Submitted	Peer reviewed journals
1987			1
1991			3
1997	2		1
1998	1		
1999	2		
2000	1		1
2001			1
2002		5	
Total	5	5	7

*Information supplied by SLU and UNA investigators and extracted from UNA-SLU reports.

12.10.5. Table 5. Research topic of UNA Ph.D students

Name of student	Research topic
Alberto Sediles	Epidemiology and management of white-fly-transmitted gemini-virus in Tomato in Nicaragua
Aldo Rojas	Biology and Molecular epidemiology of white-fly-transmitted gemini-virus in tomato in Nicaragua
Benigno Gonzalez	Integral management of the Forest ecosystem in the Chococente Biological Reserve, Nicaragua.
Francisco Salmeron	Sustainable agricultural systems in sub-watershed number 3 of the Managua lake
Freddy Aleman	Studies on bean-maize production systems in Nicaragua
Guillermo Castro	Integral management of the Forest ecosystem in the Chococente Biological Reserve, Nicaragua.
Guillermo Reyes	Biotechnolgy as a tool for breeding of Ccoyam <i>Xantosonia sagittifolium</i>
Margarita Cuadra	Biophysical analysis of natural resources use: comparison of two coffee production systems in Nicaragua
Nadir Reyes	Animal nutrition and management; feed value for ruminants of crops/plants suitable for marginal grazing areas including hillsides
Oscar Gomez	Characterization of the genetic diversity in common bean <i>Phaseolus vulgaris</i> in Nicaragua
Telemaco Talavera	Cycling of N and P in a maize/bean rotation
Victor Aguilar	Control of ground cover in coffee

12.10.6. Table 6. UNA Participation with National Institutions

-
- National Council for Economical and Social Planning
 - National Commission of Production
 - National Council for Sustainable Development
 - Inter-Institutional Commission for Food Security
 - Nicaragua Foundation for Technological Development
 - Nicaraguan Commission for Biodiversity
 - National team for Organic Producers of Coffee, Tomato and Vegetables
 - National Network for Animal Traction
 - National Team for Integrated Pest Management
 - National Commission for Seeds.
-

12.10.7. Table 7. UNA Participation with Regional National Institutions

-
- Regional Network for Distance Education
 - Regional Network for Research Education in the Rational use of Natural Resources and Agricultural Production.
 - Regional Commission for Community Forest.
-

12.10.8. Recommendations given by UNA

12.10.8.1. SAREC: Short term recommendations

- Increase the UNA-SLU budgets to 5000 000 SEK, so that, we can take in new students
 - To increase the resources for PhD program, so increasing the number of PhD student
 - To be able to reach the critical mass at UNA it is essential that PhD program include more PhD student. These students would preferably work in collaboration with old PhD student in related projects.
 - Give financial support to joint research and training programs (UNA
 - SLU) to be implemented in Nicaragua.
 - Possibilities of giving resources to enlarge the PhD, considering dissemination of results to farm conditions
 - To enlarge the actual collaboration including the diffusion of research results
 - To develop tools for measuring the impact of the Swedish aid.
 - Do not stop the aid (Continued being as supporting as now)
 - Identify what the priorities are, based on a diagnosis and make changes if needed,
 - Support the training of about 10 more MSc provided that UNA employs new young teachers for this.
-

- Support post-doc research and or post-doctoral studies
- To continued given institutional support to UNA (To broaden the available funds for institutional strengthening (Master plan))
- To establish a closer communication with Universities that accomplish research projects.
- To get literature (electronic way)
- To continues supporting the development of information systems (Library) to strength research.
- To support or include the component of information technology which guarantees the development of teaching, research and external work (Projection)
- To swift disbursement of funds (To give found in time and form)
- To provide some extra funds to elaborate technical bulletins, brochures and to get basic equipment.

12.10.8.2. SLU: Short and long term recommendations

- To enhance links with other program at UNA in order to know about PhD student advances
- Give recognition to those staff members who work in program like UNA-SLU
- SLU rector recognize the importance of cooperation with universities in developing countries
- Involve Swedish researchers in local research projects (outside the PhD pmgram) in order to help formation of UNAs Nicaraguan Researchers
- SLU teachers/researchers give some academic courses in Nicaragua, and or seminars
- To involve more Swedish student in The Program
- To develops a particular strategy to support and stimulate as much as possible the development of the critical mass at UNA
- To extend the area of training in agro business and in rural development as an important area to be strengthened at UNA

12.10.8.3. SAREC: Long term recommendations

- To consider familiar scholarships in order to support woman participation in PhD training.
- There is a need to discuss the possibility/risk with OGMs in relation to the third word, including Nicaragua. Support for education of the staff, information to the public, and Laboratory equipment
- Establish and strategic plan for institutional development in Nicaragua and follows it
- Be flexible and open mind when it comes to understand other needs.
- Keep supporting education in Nicaragua (it is the best way of helping)
- Support UNA
- SLU in anticipation of UNA could examine their own PhDs with joint supervision from UNA and SLU.
- Support 1-3 larger transdisciplinary projects achieve jointly by UNA-SLU

- To give financial support to interinstitutional and multidisciplinary research program oriented to rural development (To give specific funds for multidisciplinary program)
- To provide extra funds for training and studies of the impacts as products from the cooperation
- To maintain the cooperation program of research on persistent approach.

12.10.8.4.. UNA: Short term recommendations

- To have a clear operative plan for the program
- To finish the master development plan (Infrastructure, research, training)
- Make wiser uses of the SLU aid
- Redefine/reconsider the philosophy of sustainability
- He or at least take specific steps towards economic independence
- To make a strategic plan of the research, where we are going and what will be the objectives?
- Open the discussion for the critical mass in order to have more ideas about the future of the research, academic development and collaboration with other institutions
- To establish a fluid communication about the opportunities that UNA has for research in collaboration with other institutions.
- To conform interdisciplinary research groups at UNA along with other institutions.
- Development of a research agenda for short, medium and long term along with other authors, and based on the main necessities of the society and in correspondence with UNA mission.
- To organize the research systems, selecting research lines that could be determined previously, and create work groups with objectives and responsibilities clearly defined.
- Define the number of total PhD students (PhD) its needs at any period
- Define the police and research lines for the future PhDs (Salary, positions)
- Cooperate internally and externally
- UNA must improve the mechanism of spreading research results
- Make research teams that include Swedish and Nicaraguan student at undergraduate levels
- Broaden the collaboration (Collaborative work) with SLU in fields more that PhD program (Initiate a discussion or negotiations to post-doc studies)
- Employ new young teachers
- Make command of English requirement for MSc also at UNA
- Introduce a promotion scales rewarding research and teaching abilities / To define a (scalafon) and motivate to do research / To define, approved and implement new salary scales.
- To develops, not only the scientific capacities to do research, but also the institutional capacities (Library, Computer lab etc)

- To make and to present yearly, at national levels, the evaluation of the Nicaragua
- Swedish cooperation, considering impacts, incidence, results and products.
- Make more clearly and compulsory a gender policy
- The selection of candidates for MSC or PhD must be in agreement with the UNA staff formation master plan, so that strengthening weak areas
- To extend the cooperation to a level of (PASANTIA) informal education in academic areas, which will permit training to a higher number of UNA staffs.
- To reorient the research lines, which will permit to solve the more critical problems from the agricultural sector, so that giving better impact
- To strength the cooperation in Postgraduate education, specially in Socioeconomic and Community development
- To define precise clear indicators those permits obtain the degree of advance and fulfillment from program/projects.
- To ensure that research projects and activities of the PhD student are in close relation with the research lines from UNA.
- When choosing a new PhD student (if we get that opportunity) I think it will be advisable that they work together with the old student in the same/similar projects
- Improve the communication between the PhD
- Program, DIEP, dean and faculty/ Improvement of communication approach
- To define more clearly the rules of the PhD Program

12.10.8.5. UNA: Long term recommendations

- Promote more interaction among coworkers (team groups)
- Develops its own capabilities/capacities
- To initiate a policy that allows the women to become member of the research programs

12.11. General situation of UNI

12.11.1. Recommendations given by UNI

12.11.1.1. Long term recommendations Sida/SAREC

- SAREC should coordinate/promote together with SIDA, the link university research productions and the community or industrial applications.
- SAREC should support a strategy for post-graduate research continuation, in order to contribute the academic career at the Nicaraguan institutions.
- SAREC should encourage the institutionalization of the research management, strategic planning and the design of the operational mechanism to fulfil the University strategic research objectives.

12.11.1.2. Short term recommendations to Sida/SAREC

- SAREC should consider an adjustment on the subsistence grants for the researchers.
- SAREC should allow the flexibility, on the "sandwich" model concept, required from the research projects to fulfil the research goals.
- SAREC should support most frequent and longer visit from the Swedes supervisors and researchers. to get involved and participate closely in the research environment in

12.11.1.3. Long term recommendations to UNI

- UNI should review , propose and approve (when applicable) as soon as possible all those legal organizational, planning, and administrative issues related to research (e.g.: definition of' the Scientific Council role, establishment of Research, definition of research management, the national research promotion law, etc.
- UNI should create and increase funds to strengthen the links between research and society as a sustainable strategy (e.g. industry, government, NGOs, *liaison*).
- UNI should establish the academic career, assuring the research institutionalization based on international accepted norms.

12.11.1.4. Short term recommendations to UNI

- UNI should establish an emergency plan to encourage researchers to obtain results along the present year.
- UNI should allow flexibility on the -sandwich" model concept, required from the research projects to fulfill the research goals.
- UNI should guaranty the infrastructure needed for research (e.g: laboratories, infrastructure improvements, new laboratory infrastructure research computers and reading room etc.)
- UNI should promote interdisciplinary cooperation between the existing research programs amongst the Universities in Nicaragua.
- UNI should start up spreading the facts and results from the university research activities

12.11.1.5. Taller – UNI, -Evaluación de la Cooperación Sarec -Nicaragua

18 de febrero de 2002

Objetivo del taller: *En base a las conclusiones preliminares de la evaluación, proveer insumos para el diálogo continuo sobre el futuro desarrollo de los programas de apoyo Sarec en la UNI, y en las universidades en Nicaragua en general*

Programa

- 9.00-9.15 Introducción
- 9.15-9.45 Presentación de las conclusiones preliminares de la evaluación
- 9.45-11.30 Trabajo en grupos de reflexión
- 11.30-12.00 Discusión y conclusiones finales

13.30-15.00 Espacio para seguimiento de otros temas/ temas pendientes)

Grupos de reflexión

A. Los roles de los diferentes actores en la cooperación Sarec entre Nicaragua y Suecia:

- a) ¿Cuál es el rol de la contraparte Nicaragüense y Sueca respectivamente?
- b) ¿Cuáles son los incentivos de la contraparte sueca en participar?
- c) ¿Dónde residen los poderes de decisión? – tanto a nivel interno de la UNI, como en relación a las contrapartes suecas
- d) ¿Cómo se alcanzaría una relación simétrica en la cooperación?

B. Sostenibilidad de la investigación en la UNI :

- a) ¿Cómo se garantiza que la investigación sea una función permanente de la universidad?
- b) ¿Cuáles son los criterios para evaluar las actividades investigativas?
- c) ¿Cómo se garantiza que el investigador tenga el status de profesor y se evalúen equitativamente?
- d) ¿Cómo podrían los fondos del Consejo Científico utilizarse de una manera más estratégica?

C. La vida después de la cooperación Sarec:

- a) ¿Cuándo se alcanza la masa crítica de investigación?
- b) ¿Cuánto tiempo debería durar el programa de investigación de Sarec – y cuáles son los criterios para finalizarlo?

¿Cuáles motivos justificarían la finalización de un programa en marcha?

12.12. Analysis of SAREC support to Nicaraguan Universities: Lea Velho March 2002

EXECUTIVE SUMMARY

- The Higher education system in Nicaragua is constituted by 33 institutions: 4 public universities, 27 private universities and 2 higher technical centres. HE institutions are entitled by law to receive 6% of the national budget, which is allocated only to 10 of the mentioned 33 institutions. Among those 10, Universidad Autonoma de Nicaragua en Managua (UNAN-Managua), Universidad Autonoma de Nicaragua en León (UNAN-León), Universidad Nacional de Agricultura (UNA) and Universidad Nacional de Ingeniería (UNI) receive about 73% of the government funds to HE.
- Access to public HE is the privilege of few, since the mean years of schooling in the country is 4.6. University drop out rates are high, less than half of those who finish coursework manage to graduate. For those who graduate, compatible jobs are not easy to find.
- University students are not stimulated to do research as most teachers are not engaged in this kind of activity. Despite receiving a significant proportion of government revenues, the universities claim that they spend about 80% of their budget on salaries and the remaining part on teaching-related expenses and maintenance. Therefore, universities have to rely on extra-mural resources for funding research activities. Since there are no domestic funds where universities can apply for research grants, this gap is filled by international co-operation. SAREC is the main foreign donor funding research capacity building in Nicaragua universities, being the only long-term support universities may count on.
- SAREC has been working in Nicaragua since 1981. In the last 20 years SAREC has established co-operation programmes with the four public universities, namely UNAN-Managua, UNAN-León, UNA and UNI, covering a wide range of scientific fields in geology and ecology, medical sciences, agriculture and engineering. More recently, a small grant has also been provided to the National Council of Universities (CNU) for common development projects.
- SAREC's main objective is to strengthen research capacity and develop research works that contribute to the development of Nicaragua. The strategies to achieve this have varied: an early focus on problem solving was replaced by research training of local faculty members through the "sandwich model" and, more recently, actions were taken towards fostering the development of a research environment at the institutional level.
- This report presents an analysis of the conceptual basis of the co-operation model adopted by SAREC in Nicaragua. The intention is to contribute to "the process of identifying the size, components and direction of the future co-operation both at a local level and at SIDA", as expressed in the ToR. It also covers most of the specific issues listed in the assignment, as they are needed to provide evidence to and as they fit into a broader argument.
- The analysis is based on the following sources of information and references: official documents provided by SIDA/SAREC (from policy documents to annual reports produced by the co-ordinators of the programmes in Nicaragua, to previous evaluation reports on the Nicaragua co-operation programmes); my own personal notes of the interviews carried out with Swedish and Nicaraguan researchers involved in the various projects; interview notes with other stakeholders in Nicaragua; draft reports from EM and TA; 14 group reports of the evaluation workshops; documents provided by the universities, including the synthesis documents prepared specially for the evaluation team; relevant literature articles and documents and the ToR of the evaluation.

- Despite SAREC’s recent concern with fostering an institutional research environment, its support is still very much centred around the training of faculty members, mostly through MSc, Licentiate and PhD sandwich training in collaborating institutions in Sweden (about 85% of the resources are spent in this type of support). To the present 3 PhDs were produced in the 4 universities and a considerable number of Masters and Licentiates – 30 and 13, respectively. There are, presently, 14 faculty members enrolled in MSc and 28 in PhD studies. In the course of their training, Nicaraguan researchers have published a significant number of papers in national and international journals.
- In the light of the results presented, taking into consideration the social and economic context of Nicaragua, and assessed on the basis of its own objectives (that is, building academic research capacity) the programme is believed to be very successful.
- This notwithstanding, the point is made that the impact of the programme outside the universities is very limited. This is attributed to the model of support granted by SAREC which, it is argued, lies on three main assumptions: A1. Research capacity in local universities will, by some kind of implicit and not-stated mechanism, sooner or later, contribute to the development of Nicaragua; A2. The preferred (because believed to be the most effective) way to obtain academic research capacity is through the formal Master and Doctoral training of faculty members; A3. The Master and Doctoral training should be provided by Swedish universities which are involved as collaborating partners in the programmes, and take the format of a “sandwich” training.
- Analysis of A1 makes the point that SAREC’s support to Nicaragua still adopts a linear model of innovation framework. Although, in *discourse*, SIDA and SAREC have adopted the systemic approach, the *practice* of the co-operation is still shaped according to the paradigm of the 80’s. It is the adoption of such a linear model that explains, in part, the privileged support it grants to research capacity building in terms of Master and Doctoral training in the four universities.
- Analysis of A2 concludes that although research capacity is essential for Nicaraguan universities and also for contributing to development, it does not seem to be the case that PhD and MSc training is *the only* or *the most appropriate* and *efficient* way to achieve it. Without advocating for a termination of support to PhD training, and even recognising that in some cases it may be appropriate, it is suggested that other forms of research training should be devised and implemented with SAREC support.
- Analysis of A3 argues that SAREC could consider drop the requirement of degrees being granted by Swedish institutions, that some training could be performed within the regional programs in CA and LA and that the sandwich model *does not* seem suitable as a *model for all occasions* (the universal model).
- Concerning the issue of programme ownership, it is pointed out that Nicaraguans have to face asymmetry at two levels: in relation to the Swedish counterparts who, by being supervisors are, naturally, in an authoritative position; and in relation to SAREC who, by being the only long-term research supporting donor, negotiates from a strong position and has an almost unlimited decision power.
- It is emphasised that it is very important for the universities and for Nicaragua that SAREC support continues. Also, as already said, the achievements of the collaboration, within the framework in which it was devised, are quite impressive. However, the recommendation is that if the collaboration wants to have the greatest impact on research capacity building that is relevant for development, a number of new directions would have to be implemented. Although some are suggested here, they would have to be decided and devised by the Nicaraguans themselves.

I. The development context of the project

Nicaragua is the poorest country in Central America, with a GNP per capita of US\$410. Although the service sector is responsible for 44% of the GDP, the main source of foreign revenues is agriculture. The largest part of the employed population is in the service sector, and migration to urban areas has been increasing. Only 9% of the Nicaraguan territory is covered with arable land, which indicates the difficulties that the country will face to increase the share of labour force employed in the agricultural sector. The country has also a young population, high unemployment (20%) and underemployment (38%) rates, and a problematic educational system. All these factors make the country's social situation all the more dramatic. Approximately 50% of the population of 4.9 million inhabitants live in poverty and 19% live in extreme poverty.

Prior to Hurricane Mitch in the fall of 1998, Nicaragua had been pursuing a number of orthodox economic reforms and had begun to shed the legacy of a decade of civil war and economic mismanagement by posting strong annual growth numbers (around 4%). Also, the country managed to reduce its foreign debt from US\$ 11 billion in 1990 to US\$ 6 billion in 1997. This adjustment had serious social side effects. To make things worse, the storm has put the reform effort on hold and has changed economic forecasts for the foreseeable future. Nicaragua sustained approximately \$1 billion in damages as the hurricane affected some of the country's most productive agricultural lands and caused major damage to key transport routes.

As the all-important agriculture sector, which is responsible for the majority of exports, was hardest hit, it was predicted that GDP growth would slow down by at least one percentage point in 1999. Although this prediction was not confirmed and GDP actually experienced a 7.3 % growth in 1999, this was at the expenses of an explosion in trade deficit and significant foreign aid relief helped to stabilise the country. In addition, the Paris Club and other creditors offered substantial debt relief. Nevertheless, additional financing is still needed to restore the production environment to its pre-Mitch condition.

The Nicaraguan economy has, for many years, been highly dependent on foreign aid. Between 1990-1996, Nicaragua received US\$4.5 billion in foreign cooperation - roughly 35% of its GDP a year. This amount included foreign loans as well as donations, and came from 66 sources (bilateral agreements, international organisations, and non- governmental organisations). External assistance in 1998 (the last year for which data is available) was worth over US\$ 500 million. For comparative purposes, if countries are ranked by aid as a proportion of GNP, exports or government revenue, the picture for Nicaragua is particularly dramatic since it is near the top of all three lists. Data on aid as % of GNP and exports are available for 119 countries: Nicaragua ranks second in the former, with aid as 32% of GNP; and 15th in the latter, showing aid as 66% of exports (goods and services) receipts. Information concerning aid as percentage of government revenue is available for 67 countries and Nicaragua ranks 8th, comprising 101% of government revenue (World Bank 2000).

The social and economic problems of Nicaragua are well captured by the Human Development Report where this country ranks 106 among the total 162. It is particularly striking that Nicaragua (together with Swaziland) is the country with the highest internal income inequality, what shows not only poverty but a very unjust social structure. (HDR 2001). Some have attributed this increase in inequality after the Sandinista government to the impact of the economic policies adopted by the Chamorro government under IMF and World Bank guidance. It is argued that liberalisation and privatisation did not create a competitive market economy, but tended to favour a small group. Thus, even if the economic policies were successful in limiting inflation, the same was not true in achieving growth in production, nor in exports or investment. As a consequence, income distribution worsened and poverty increased. Furthermore, the foreign aid that accompanied the programmes permitted this discretionary government behaviour. (Dijkstra, 1999)

Under such circumstances, it is to be expected that enrolment in higher education is something for a privileged few. Indeed, the figures show that the mean years of schooling for the population as a whole is 4.6; enrolment in primary school reaches 77% for the 7 to 13 age group and in secondary education only 33% of the 14 to 19 age group. Not more than 12% of the 20 to 24 age group is enrolled in higher education, well below the average for Latin America (20% in 1997, the last year for which comparable information is available at UNESCO 2000).

Government commitment to education in Nicaragua, as shown by public spending, is considered to be quite low: 5.4% of GNP in 1998. The largest percentage of such amount goes to primary education (45%), 17% to secondary education and about 23% to university education (Human Development Report 2000). Data compiled internally in Nicaragua for the year 1998 indicates that around 50,000 students were enrolled in universities which are part of CNU (National Council of Universities which comprise public and not-for-profit universities) and 30,000 in private universities. A great part of those university students have difficulties in finishing their courses: drop out rates from universities reach 63% (Plan Nacional de Educación 2001: 19). It must also be considered that official statistics do not clearly differentiate among those who finish universities with a degree (*graduados*) and those who finish all course work but do not get their professional degree for the lack of a final monograph, research work, report of practical work or final general examination (*egresados*). Of those who do graduate, less than 20% do so by having carried out a research work – most of them prefer to take the final graduating examination (interview with the rectors of the four public universities). The latter is, according to many of the people interviewed for this study, a distortion of the system: the examination was institutionalised in order to solve the problem of the high proportion of *egresados* which never graduated. In order to take such examination, candidates are expected to attend an intensive 3 months preparatory course to which each student pays around US\$700. Since there is a high coincidence between those who attend the course and those approved in the examination, the tendency is for ever higher number of enrolment in the course. University faculty members are the ones teaching in these preparatory courses for which they get part of the student fees.

A revealing figure of the dramatic losses during the whole education system in Nicaragua and, consequently one that must be taken into consideration when planning, analysing and evaluating research capacity building in Nicaragua is: for each 100 students entering primary education, only 2 graduate from higher education (Plan Nacional de Educación 2001: 19). And then those graduates struggle to find jobs and many educated Nicaraguans leave the country to look for professional opportunities elsewhere. Census data on international mobility of high skill personnel from LDCs to the United States show that, based on data, in 1990 (the last year for which data is available) there were almost 25,000 Nicaraguans with university degrees who had (officially) immigrated to the US (Carrington & Detragiache 1998). Although some may have returned to Nicaragua with the electoral defeat of the Sandinistas and although is not known how many of those obtained their degrees in Nicaragua or in the US, there is no denial that 25,000 graduates represent quite a loss for a country like Nicaragua.

Many graduates seek career opportunities in the non-governmental sector, and a large share of the most educated Nicaraguans are working for local and foreign NGOs. These organisations mushroomed in the last ten years. During the 1980s, the Nicaraguan government registered 114 NGOs. From 1990 to 1997, the number of new NGOs increased to 1615. Between 1990 and 1995, these NGOs channelled US\$316 million into the country. (Nicaraguan Ministry of Cooperation 1996 and 1997)

The higher education system is constituted by 33 institutions: 4 public universities, 27 private universities and 2 higher technical centres. The Nicaraguan higher education institutions are entitled by law to receive 6% of the national budget. For a number of years, there was a heated debate between

government and universities about how such percentage should be calculated: the university rectors claimed that this number should be calculated upon the expenditures, which include foreign assistance. The government, on the other hand, transferred only 6% of its revenues to the universities and colleges. In 1996, for instance, this meant a reduction of US\$ 8 million in the actual total transfer of US\$ 20 million. This despite the existence of a law passed in 1992 which prescribed that state contribution to HE should take into account both regular and extraordinary revenues, independently of the source of such incomes (Brunner & Eduards 1994: 17). However, during the government of Alemán, an agreement was reached between government and CNU whereby a 12% increase per year in the transfers to the universities would be made. It was also agreed that investments in buildings or basic infrastructure would not be included in the 6% conventional transfer, but were to be negotiated on a case by case basis between the university and government (CNU-P 2001). It is also worth pointing out that HE institutions are exempt from all kinds of taxes and freed from paying public services such as water and electricity supply, telephone and post. (Brunner & Eduards 1994: 16). This certainly adds significantly to public spending in HE in Nicaragua and is frequently forgotten by those who collect this kind of information.

Of the 33 higher education institutions, only ten are part of CNU and receive governmental funding. The latter is allocated by CNU to each institution according to criteria that include the number of students enrolled in each institution and whether or not those students have to pay fees. For example, in 2000 the Catholic University (UCA) decided to charge fees from students and was excluded from the 12% increase in that year. In practice, resource allocation follows closely a historical pattern, which reflects power distribution among institutions (CNU-S 2001).

The same law that established the percentage of government income that should be allocated to universities also established the latter's autonomy. This has an obvious implication on HE governance structures, which tend to follow Latin American pattern. This means that there is "formal pre-eminence of collegial bodies, elected authorities and tripartite government in the tradition of the Córdoba Reform Movement of 1918, with the participation of teachers, students and non-teaching staff" (Brunner & Eduards 1994: 14). Understanding the significant role that internal politics can play in such a governance structure, and that it is part of the Latin American culture and is very unlikely to change substantially in the near future, is essential for policy-makers, donors and analysts of all kinds.

Government funding is basically what the public universities may count on to carry out their activities. According to the rectors, present budgetary allocations cover only their needs for teaching. Faculty and administrative staff salaries account to over 80% of universities' budget. Therefore, there is practically nothing left to cover research activities. This fact in itself would not mean much. Actually, it is almost the norms for universities these days, even in many developing countries, that research activities must be funded from extramural resources, such as national research councils, research foundations and the private sector. What is serious in Nicaragua is there are no local such external sources. A research council (Consejo Nicaraguense de Investigación, Ciencia y Tecnología – CONICYT) has been nominally created but has yet to be institutionalised. Despite the existence of an executive secretary for the Council, there is no budgetary allocation. Also, the interview with the then secretary in the Alemán government revealed that support for research was not contemplated by the Council in the short run. In his words:

"We have two priorities: technological development through the 'proyecto semilla' [seed project] in the fishing, milk and tourism sectors with funding from IDB [Interamerican Development Bank]; and developing a legal apparatus for IPRs [intellectual property rights]. Scientific research is something we may think of in the future, if we have time, energy and money". (CONACYT-S 2001).

Such declaration coincides with the available hard data: research and development (R&D) expenditures as % of GNP is reported as zero, the same for private sector investment in R&D (HDR 2001, p. 54). Besides the lack of adequate funding, research activities in Nicaraguan universities face other serious problems. These institutions are teaching-oriented, and do not reward or encourage research. This means that there is no academic career based on academic degrees or research publications. Faculty members are civil servants, have tenure and are promoted according to seniority in the job. Most of them are full-time teachers (about 75% for the 4 public universities) and are expected to spend 12 hours teaching per week. The rest of their time they should be preparing classes, attending to student needs, doing research, extension or administrative work. However, as salaries are considered to be very low, and administrative posts are the only ones for which they can receive extra pay, some (and many of the most qualified ones) go into administration and many others take jobs outside the universities.

It has been consistently shown that government underfunding and low salaries pose considerable threats to the sustainability of institutions and, obviously, of the functions they are expected to perform (Godfrey et al 2002). And both of such conditions are present in the HE system in Nicaragua. Without proper funding and without financial or promotion incentives associated with research activities, research is clearly not a priority.

Without funding from local sources, research efforts are totally dependent upon foreign funding. As the international aid for research has been shrinking, due, among other things to donors fatigue caused by the “low performance of programmes”, research activities in Nicaragua are under threat. Actually, as the Rector of one of the four public universities declared in a meeting with the evaluation team: “SAREC is the only significant and long term source of research funding for the universities. Under these circumstances, any contribution we receive is important and we have to do what we can in order to guarantee its continuity”.

It is in such a context that this report analyses the support granted by SAREC, the research division of the Swedish International Development Agency, to the Nicaraguan universities. A brief history of this support is the objective of the next section.

II. The project history

SAREC has been working in Nicaragua since 1981. According to its officials, the agency’s main objective is to strengthen research capacity and develop research works that contribute to the development of Nicaragua. The emphasis in this programme is on capacity building in Nicaraguan universities, and the main component of the Swedish cooperation policy is the training of faculty members. As part of this effort, SAREC has also funded two studies on the status of higher education in the country (Brunner & Eduards 1994; Rojas & Dahlgren 1998). Another purpose of these studies was to assess the impact of the recent efforts to reform the university system.

In the last 20 years SAREC has established co-operation programmes with the four public universities in Nicaragua, covering a wide range of scientific fields in agriculture, engineering, medical sciences, geology and ecology. This partnership seem to have initiated in 1980 with a support granted by SAREC to a project on red beans developed by the General Directorate of Agriculture of the Ministry of Agriculture of Nicaragua (DGA-MIDINRA) in cooperation with the Swedish University of Upsalla (SLU). Red bean is one of the main Nicaraguan staple foods, and the objective of this research programme was to increase its productivity.

From 1985 to 1987 the project was gradually transferred to the Faculty of Agricultural Sciences and Livestock (FCCA) of the National Autonomous University of Nicaragua (UNAN), given that the research division of DGA-MIDINRA merged with the FCCA-UNAN (which became National Agricultural University – **UNA** – in 1990). For this move from the Ministry to the University it was also important that the Swedish counterpart was interested in extending the cooperation to the education area. It was realised that research training of the Nicaraguan participants was important for the success of the programme. Thus, from 1984 to 1987, 2 members of DGA-MIDINRA and 2 faculty members of the University started MSc training within the programme.

In 1987 the partners reassessed the programme and decided to broaden it. They included other crops and disciplines, like genetics and plant breeding, plant health, and renamed the programme Plant Science. In 1995 the programme was extended to include both PhD training and other research fields such as genetic resources, forestry and animal science. In the last few years (since 1997), support from SAREC has extended to other research related activities besides the formal graduate training of faculty members. This includes institutional support and resources made available to projects to meet specific detected needs such as curriculum development – both of which are localised and tend to be discontinued with time. However, another type of support, to the so-called Research Council appears to reflect a significant change in perspective and to point to an increasingly important activity in the future of the cooperation.

SAREC's support to Universidad Autonoma de Nicaragua-León (**UNAN-León**) started in 1983 with a programme on infectious diseases. A negotiation process initiated when the university received the visit of 3 Swedish experts on mission for SAREC. In conversations with local faculty, the mission team was presented with projects which contemplated the study of health problems affecting the local population. The projects were also discussed with local government health officials, giving rise to two lines of investigation, namely infant diarrhoea and parasitic infections. As time went by, two more lines of investigation were added, namely antimicrobial resistance and bacterial antigens. A second co-operation programme with UNAN-León began to take shape in 1986 and started activities in 1987 on occupational health. Later the programme was expanded so as to include two more lines of research, namely reproductive and child health and mental health.

In 1983, the Sandinista government promoted a broad reform in the higher education system and, among other measures, grouped all the Engineering courses in one university - **UNI** (Universidad Nacional de Ingeniería). Since the inauguration of the new university, the faculty of Chemical Engineering has sought cooperation agreements to develop its research activities and to train its faculty. In 1986, they prepared a proposal to ask for SAREC's support. As a response to this request, SAREC implemented an agreement between UNI and the Swedish Royal Institute of Technology (KTH). The main goal of that agreement was to build local capacity in areas that were deemed relevant to local industries. The areas of concentration chosen by the Nicaraguans in chemical engineering were drying technology; extraction; and crystallisation.

The cooperation programme supported by SAREC at the faculty of Electrical Engineering of UNI was initiated in 1991, although training activities started only in 1993. It involved either KTH or Lund University as Swedish counterparts. The selected areas for support were industrial control systems and data communication. In 1998 a new area was introduced – applied electronics.

SAREC support to research at Universidad Nacional Autonoma – Managua (UNAN-Managua) began with an agreement with the geoscientific research centre (CIGEO) in 1997, being thus the most recent of SAREC's cooperation programmes in Nicaragua. The primary goal was to build, equip, and create research capacity at CIGEO. In 1999, SAREC and UNAN-Managua decided to extend this

programme to other units of the university: the Centre for Aquatic Studies (CIRA), the College of Medicine, and the College of Natural Sciences (the latter two have not initiated yet). It became a multidisciplinary environmental programme. This change was aimed at constituting multidisciplinary teams in fields like environmental toxicology and environmental chemistry. The first students from CIGEO and CIRA began their training in 1999. CIRA will send a second student to Sweden in autumn 2001. At the Faculty of Medicine, plans are being made to begin with two students in 2001. Swedish counterparts are, the Dept. of Geotechnology, Biotechnology, and Ecology at Lund University.

Besides the programmes in the four public universities, a small grant is provided to the National Council of Universities (CNU) for common development projects. This has been spent on audits contracted out to PriceWaterhouse consultants, other management related activities, funding of two national research conferences open to all Nicaraguan institutions, and the publication of the CNU journal entitled *Universidad y Sociedad*.

As seen above, SAREC has supported research activities in Nicaragua for about 20 years. According to its official documents, the SAREC's main objective is to strengthen research capacity and develop research works that contribute to the development of Nicaragua. Since its beginning, however, the instruments whereby SAREC has supported capacity building in Nicaragua have varied. Thus, the early focus on problem solving was soon realised as not contributing much to building research competence within the country and was replaced by research training of local faculty members through the "sandwich model", in accordance with SAREC's main policy (SIDA 1998a).

Today, SAREC continues to support research training at the individual level (sandwich PhDs), but has moved from almost exclusive support to individual PhD students to fostering the development of research capacity/environment at the institutional level (statement from SAREC's officer responsible for the co-operation with Nicaragua). In order to achieve such broader objective, SAREC has devised and applied the following forms and instruments of support:

- Liaison project: to foster the contact of highly trained researchers with other segments of society (industry, social sector demanding technological assistance) (devised and negotiated with UNI, but apparently not yet functioning)
- Research council: to promote research activities by competitive proposal submission for small research projects, organisation of scientific and technical meetings within the universities, participation of local faculty members in international scientific and technical meetings, dissemination of research results – this kind of support is open to all faculty members and not restricted to those directly involved in the SAREC collaboration programmes – this type of support has different names in each university (Medical Faculty Support at UNAN-León; Research Direction at UNAN-Managua; Scientific Council at UNI and Research Council at UNA).
- Administrative development and research management: to consolidate management and administration capabilities at the universities by supporting various processes, as per each university's needs and demands. For example: curriculum development and administrative efficiency and transparency at UNA; support to start a process for assessment and accreditation programme for UNI; planning for cooperation at UNAN-Managua.
- Support for information and communications technology and equipment – a special project, co-ordinated by UNI which will modernise connectivity to Internet and facilitate communication for all 4 universities (not implemented yet)
- Library Support

- Training of Faculty Members through MSc and PhD “sandwich” programmes

The support granted by SAREC to Nicaraguan universities has been subject to a number of evaluation exercises during this 20 years period. However, in November 2000 SIDA's Research Council decided that an evaluation of the whole co-operation should be carried out, so that the past experience could be used to inform the planing and shaping of a new co-operation. This report is part of the activities that took place to respond to the mentioned decision of SIDA's Research Council. How this was done and with what focus will be described in the next session.

III. The evaluation

Reasons for the Evaluation

According to the Terms of Reference (henceforth ToR), the “overarching objective of the evaluation is to make a proposal on the future direction of the research cooperation and means for its implementation with the purpose of making the cooperation more sustainable and efficient” (ToR 2001-06-12: 2(7)).

The justification given was that after almost 20 years of co-operation, it was time to reflect on the efficiency of the co-operation and on the objectives it aims to achieve in the future. Also, the ToR stated that “until now no evaluation has tried to analyse and elucidate results, experiences and the way forward for the whole research co-operation” (ToR 2001-04-08: 2(5)).

I was approached by SAREC to be part of the evaluation team in January 2001. A ‘very draft’ of the ToR were sent to me in April and questions I had about them were not answered by SAREC. For me, at the beginning, the fact that the ToR were not fully discussed seemed not to be very important, because my understanding of the role of ToR is that they are general statements to guide the study process. Moreover, the way I see things, is that before a better knowledge of the programme under evaluation and of the local social context where programmes takes place, it is impossible to know whether specific questions posed by ToR may or may not be satisfactorily tackled in light of the programme context. Therefore, I was happy with the general objective expressed in the ToR and believed I could contribute to its achievement. In addition, I trusted that the specific questions had been written by a country officer who knew the programme and the country well and, therefore, had framed questions for which it was feasible to find answers during field work.

An evaluation team of three people (myself as team leader) was put together by SAREC in Stockholm without consultation of any kind to the team leader neither to the universities in Nicaragua. One of the members of the team was a medical researcher from Costa Rica (EM) and the other a Swedish specialist in water management (TA) who, together with his evaluating function was in charge of managing the administrative aspects of the evaluation mission through his consulting company (Akkadia). I am a science and technology policy researcher, with considerable experience in S&T policy analysis, but I am not a professional evaluator (LV).

Methodological Procedures

Two of the team members (TA and LV) met in Stockholm in May 2001 together with SAREC programme officer in the evening before field work was to start in Sweden, without time to get to know each other or to discuss the ToR and the methodology to be used. In the middle of the week we were joined by the third team member and, together (sometimes the three of us, sometimes two), we had a series of interviews and conversations with SAREC programme officer for Nicaragua (1 meeting of 2

hours) and Swedish counterparts of the co-operation. It is important to clarify that Swedish counterparts, for the co-operation programme with Nicaragua are, without exception, *supervisors* of the Nicaraguan faculty members who are enrolled in graduate programmes in Swedish universities.

Therefore, any time in this report when I refer to partnership between Swedish and Nicaraguan researchers, this is always a specific kind of partnerships where the Swedish partner is an established professor/researcher in a Swedish institution and the Nicaraguan partner is also a established teacher in a Nicaraguan university and at the same time, a graduate student working under the supervision of the former.

Interviews with Swedish counterparts sometimes took place with just one of them, sometimes were collective conversations. Example of the latter were the 3 hours conversation held at the University of Upsalla involving the whole evaluation team, 3 Nicaraguan participants who, coincidentally, were there in the occasion and all Swedish supervisors of Nicaraguan students (about 8 Swedish researchers). Another collective conversation was between two team members (EM and LV) and the Swedish counterparts of the infectious disease programme of UNAN-León working at the Karolinska Institute.

The interviews were open and not structured. This notwithstanding, they tended to cover similar questions such as the views of the Swedish counterparts on what was and was not working well in the co-operation and why; the main changes needed; their vision of the future of the co-operation; questions of ownership and sustainability.

A work plan for the fieldwork in Nicaragua was prepared by the team leader and submitted to the other team members, SAREC programme officer and programme co-ordinators in Nicaraguan universities. This plan asked for a detailed report of the programmes' history, achievements (quantitative and qualitative), problems, links developed with other social segments, etc to be prepared by each university. Also, as the ToR asked for participatory methods, workshops were designed to take place at each university with extensive participation of stakeholders. The latter were defined in the work plan as "faculty members that have been trained and are under training with support from the cooperation; other faculty members that have **not** been directly involved in the cooperation; undergraduate and graduate students **that have** and **that have not** direct involvement with faculty members trained under the cooperation scheme; non-university people such as policy-makers at local, regional and federal government; actual or potential research users in civil society (actual or potential research users are to be identified by the co-ordinators of the cooperation programme. In the case of UNA, research users include, among others, coffee growers organisation representatives, other farmers' organisations; agricultural extension workers; NGOs working in agricultural development; etc.)". (work plan: 4)

Fieldwork in Nicaragua developed according to the plan. A workshop with stakeholders (as identified by the universities themselves) were carried out with a considerable number of participants. Presentations of the history of the programme and of the evaluation exercise were followed by group discussions. Each group indicated a reporter who presented the main points and conclusions in a final plenary session. All groups handed out their reports to the evaluation team. In total, considering the 4 universities, 14 group reports were produced: 3 for UNA, 4 for UNI, 3 for UNAN-Managua and 4 for UNAN-León.

Following the workshops, team members conducted interviews with a variety of stakeholders: ambassador of Sweden to Nicaragua, SIDA representative in Nicaragua, rectors of the 4 universities, executive secretary of CNU, SAREC programme co-ordinator in each university, faculty members linked and not linked to SAREC programmes, undergraduate students, and people outside the university. Each team member became responsible for the interviews in each university: EM for

UNAN-León; LV for UNA, TA for UNAN-Managua. UNI was taken together by LV and TA. A first draft of the report by EM and by TA were sent to me.

In short, when I, as team leader, was preparing to write a first draft of what was to be the general report, I read and based my reflection on the following pieces of information: a number of official documents provided by SIDA/SAREC from policy documents to annual reports produced by the coordinators of the programmes in Nicaragua, to previous evaluation reports on the Nicaragua co-operation programmes; my own personal notes of the interviews carried out with Swedish and Nicaraguan researchers involved in the various projects; interview notes with other stakeholders in Nicaragua; draft reports from EM and TA; 14 group reports of the evaluation workshops; documents provided by the universities, including the synthesis documents prepared specially for the evaluation team; relevant literature articles and documents and the ToR of the evaluation.

That was when I made the decision that I should concentrated my analysis on what I believed to be the conceptual basis of the co-operation model adopted by SAREC in Nicaragua. My reason for this was that if SAREC was really interested in “using the findings of the evaluation in the process of identifying the size, components and direction of the future co-operation both at a local level and at SIDA” as expressed in the ToR, it would not be enough to cover the specific issues listed in the assignment. Such issues would be covered as they were part of a broader argument, but not as specific and separate items where they would appear too detached of the general argument as if they had existence on their own.

I decided, then, to build and develop the argument as a first draft, submit it to discussion with the other team members and with the SAREC programme officer. Such dialogue was expected to give rise to a collective document which then would be sent to programme participants for discussion in the final workshop in Nicaragua. Things, however, did not turn out as expected for a number of reasons not worth mentioning here. The fact is that substantial comments were received only by one member of the team (EM) and by Swedish researchers from Upsalla (the counterpart of UNA). Those comments were taken into consideration when revising the draft report to this present form.

Limitations of the study

Obviously, being an authored document of which I am the only author, it reflects exclusively *my view* of the policy adopted by SAREC to contribute to research capacity building in Nicaraguan universities. This view, however, was constructed within the most rigorous principles of scholarship as practised in my field of study.

IV. Results

Despite the different types of support that SAREC is funding in Nicaraguan universities – institutional support, research council, library and IT support - the greatest part of the financial resources channelled to Nicaragua is still dedicated to funding the research projects under each programme. These projects broadly correspond to the thesis work of the faculty members enrolled in graduate studies in Sweden. In other words, although the programme the bulk of Sarec’s support concentrated on giving faculty members of Nicaraguan universities the opportunity to pursue Masters, Licentiate and PhD degrees in Sweden, adopting the “sandwich model” as will be discussed below.

Evidence of the emphasis on graduate training of university faculty members can be inferred from the information contained in Table 1. Data on the percentage of funds allocated to each type of support

make clear that the move that SAREC has implemented from focusing on faculty training, mostly through the sandwich programmes, to fostering a research environment at Nicaraguan universities is still a very timid one.

Table 1. Percentage of SAREC's Financial Support to Nicaraguan Universities spent on Institutional support mechanisms (to foster a research environment)

	Budget 2001 (thousand SEK)	% Institutional support	% research council	% faculty training
UNAM-León	6 700	14	5	86
UNAM-Managua	4 300	25	7	75
UNI	4 600	11	6	89
UNA	4 000	7.5	7.5	85

Source: Asdi 2001.

Therefore, the main action implemented in these years has been and still is the training of faculty members, mostly through MSc and PhD sandwich training in collaborating institutions in Sweden. Therefore, if we take into consideration the types and concepts of capacity building listed by SIDA's policy document, that is: individual research capacity; institutional research capacity; national research capacity; regional research capacity (SIDA 1998a: 23), it is reasonable to argue that, in the case of Nicaragua, SAREC is still concentrating in building capacity at the *individual* level.

Given the centrality of training of university faculty members in the research support provided by SAREC, it is important to discuss in detail the various dimensions of its conception, implementation and impact. This is my aim in the sections that follow.

Building research capacity by Training Masters and PhDs

Modalities of support such as the one provided by SAREC aim to build research capacity by strengthening the institutional conditions for research, supporting the formal training of researchers (Masters and Ph.D.s) and consolidating local postgraduate programmes. Their long-term goal is to focus on the more academic type of research capacity building in particular branches of knowledge.

Has the programme in the various universities been able to build research capacity? Have them being able to create a critical mass of competent researchers? The next section tries to answer these questions.

i.– Capacity building in Nicaraguan Universities with SAREC support

As defined by SAREC, “research capacity involves the ability to independently: identify and define researchable problem areas; plan and implement research tasks; participate in and utilise international research; evaluate, select and adapt research findings; publish, disseminate and apply research findings; offer attractive research environments; the capacity to reproduce its own capacity”. (SIDA 1998a: 23)

Let's start by looking at the number of faculty members which have been trained in the framework of the SAREC programme in each university.

Table 2. Number of Faculty Members of the 4 Nicaraguan Public Universities who obtained graduate degrees or are enrolled in graduate studies with SAREC support

	MSc/Licent Granted		PhD Granted		MSc/Lic. Students		PhD/Lic Students	
	Female	Male	Female	Male	Female	Male	Female	Male
UNA	2	20	–	2	–	–	1	9
UNAN-León	6 (1Lic)	7 (2Lic)	1	–	2	3	3	6
UNI	2 (2Lic)	4 (4Lic)	–	–	3 (1TKL)	6 (6TKL)	–	4
UNAN-Man	–	–	–	–	–	–	2	3
TOTAL	10 (2Lic)	31 (11Lic)	1	2	5 (1KTL)	9 (6KTL)	6	22

Source: Synthesis documents provided by the universities for the evaluation mission

The data contained in Table 2 show a considerable effort made by the universities and by SAREC in order to create local research capacity in the last 20 years. With all this effort, 3 PhDs were produced in the 4 universities and a considerable number of Masters and Licentiates – 30 and 13, respectively.

It is important to point out that the number of male and female faculty members involved in the programme is very different indeed: 22 female and 64 males (almost 1:3). This is not a new finding. It has been widely recognised by SAREC and also by Nicaraguan universities that something had to be done in this respect. Most international development agencies have made explicit commitments to promote gender equity through their development programmes. Some commitments are more explicit than other, some are more recent than others. Those of the Scandinavian and Dutch bilateral agencies are probably the most explicit, the most ambitious, and the most longstanding. (Leach 2000: 334). Even so, SAREC has, apparently, not taken any action to remedy this.

The reasons frequently put forward for the gender difference in participation in the programme are that fewer female than male teachers dominate the English language which is a requirement for enrolling in the programme. If this is true (and it was repeated over and over during the interviews), it is hard to understand why measures have not been taken yet – things like selecting the best candidates, irrespective of their knowledge of English, and then supporting their training in English were also consensual during the interviews.

Another common explanation is that women, given their family responsibilities are less mobile than men and, therefore cannot go abroad to study and leave the family behind. I have argued elsewhere that sandwich training is particularly hard on women and that it is more likely that a woman will face a full doctorate abroad (taking the children with her) than travelling back and forth and leaving the kids behind. Gender differences historically accumulated will not go away without higher investment and pro-active attitudes. Therefore, I strongly believe that the universities, together with SAREC, has to put forward a serious assessment of what is holding down the female faculty members, with an eye to a plan in the short and medium term to remedy this unacceptable gender differences in terms of opportunities and achievements.

Looking at Table 2 one can ask: is it possible to judge exclusively by the sheer numbers of faculty members who obtained degrees and faculty members enrolled in graduate studies with SAREC support

whether research capacity, as defined by SAREC, has been built? Of course, not, For this kind of analysis we need to refer to other quantitative data, but mostly to qualitative information collected in the course of the interviews.

If we take at face value the list of abilities that define research capacity according to SIDA's policy document as presented above, we may have to conclude that research capacity has not been achieved yet. Actually, it is very unlikely that, the greatest majority of the faculty members involved in the SAREC programmes are, at this stage, able to accomplish, *independently*, the tasks listed in that definition of research capacity. Some of such abilities have just started to build up, the most evident, the ability to participate in international research and to publish.

Nicaraguan researchers have published a significant number of papers in national and international journals. A closer look at the publication lists can reveal some further aspects of the relation between partners.

For example, the list of publications of the occupational health programme at UNAN-León shows 14 items which may be classified in the following categories: 3 Licentiate Theses and 11 publications of articles in specialised refereed journals. All 11 articles were written jointly by Nicaraguan and Swedish researchers. This, of course, is the tendency for most experimental science and could well indicate that real partnerships is taking place in this programme. More significant, however, is that of the 11 co-authors articles, 7 had Nicaraguan researchers as first authors. This is a well recognised indication that the leadership in that specific pieces of research was the Nicaraguan researchers'.

The programme of Infectious diseases of UNAN-León show similar behaviour. Of the 31 publications listed, 24 were articles published in international refereed journals and all of them are multiple authors articles. Only 3 of the 24 articles did not have the participation of Swedish authors and all 3 were published in a Brazilian journals. All other articles, that is 21 had at least one Swedish co-author and most often, more than one. However, once more, Nicaraguan researchers were the first author in the majority of the articles, that is, in 14 of them. It is worth mentioning that the Nicaraguan researchers publishing as first authors in international journals, only one (M.Caceres) has a PhD degree and she was already publishing before that (2 articles where she appears as first author were published as early as 1991). It seems, therefore, that there is from both partners a commitment to research co-operation as indicated by publication data.

The picture for UNI is very different. In the case of the Faculty of Electrical Engineering, no papers have been published in refereed journals so far and all presentations in conferences or invited papers in expositions were authored exclusively by the Nicaraguan researchers. For the Faculty of Chemical Engineering, again few papers in refereed journals (2 out of 32 publications listed) both of them co-authored by the Swedish supervisor (as second author). In addition, about complete 5 papers were published in international conference proceedings, all co-authored by the J.Martínez who is the supervisor of 8 current students.

UNA, as we can see in Table 2, had 22 Faculty members trained at the MSc level in the framework of the SAREC programme. Of these 22, 17 remain at the institution. The Masters trained by the UNA-SLU programme publish very little by whatever means we analyse it. Their publication list reveals that the 22 Masters produced 16 articles which except for 1, were published in in-house series (either at SLU or UNA) and therefore, have not been submitted to the normal selection criteria of refereed academic journals. The exception was one publication in *Tropical Agriculture*, which has a Swedish researcher as first author. The PhD holders, on the other hand have already began to show some scientific production in refereed journals (1 in *Agronomy Journal*, 1 in *Plant Disease* and 5 others submitted, plus 1

chapter in a FAO book). If this trend is kept, with 9 PhDs in line to finish in 2003, a significant number of international publications are to be expected.

The programme at UNAN-Managua is yet very recent and all reports list only a few presentations in national or regional conferences.

What the information presented above shows is that the research co-operation between Nicaragua and Sweden with support from SAREC has, in the last 20 years, been able to qualify a number of faculty members (more males than females) as expressed by the degrees they received and by the ability they acquired (some individuals more than others) to carry out research and publish their results in recognised journals.

Does this mean that the co-operation has been successful? In order to reply to this question it is necessary to look at the objectives of the co-operation as well as at the conceptual basis on which it rests.

ii. Conceptual Assumptions of the SAREC Model of Co-operation

I believe it is reasonable to argue that underlying SAREC's choice to support academic research and training in Nicaragua one can find three main assumptions, as follows:

- a.- Research capacity in local universities will, by some kind of implicit and not-stated mechanism, sooner or later, contribute to the development of Nicaragua.
- b.- The preferred (because believed to be the most effective) way to obtain academic research capacity is through the formal Master and Doctoral training of faculty members.
- c.- The Master and Doctoral training should be provided by Swedish universities which are involved as collaborating partners in the programmes, and take the format of a "sandwich" training.

In my view, these assumptions should not be taken for granted and, therefore, should be reflected upon. In what follows I will tackle each of such assumptions in turn.

2.1. Research capacity will contribute to development OR The discourses of North-South Co-operation: has anything changed (in practice) in the last 50 years?

The main argument here is that the model adopted by specific research co-operation programmes rests upon particular concepts of science, and consequently, upon particular ways to understand knowledge production and the means whereby such knowledge feeds into technological innovation or social change and, consequently, contributes to development.

Since the creation of the government institutional apparatus for science and technology policy after World War II, different "paradigms" have dominated the practice and were adopted both in advanced and developing countries (Ruivo 1994). From this time up to the beginning of the 80's, science operated under what might be described as the "Vannevar Bush social contract". Under this, governments provided funds for scientific research in the general expectation that, sooner or later, it would revert in technological development. Science was believed to be socially and historically neutral and the starting point for technological development. This view, based on the linear model of innovation which was dominant in the period, reflected on the ways research was evaluated (by reference to internal quality criteria as defined by researchers only), on the policy tools designed (mostly to foster the "best" scientific research) and also on the model of North-South cooperation most widely adopted. Thus, this is the problem-solving phase of the North-South collaboration when it was believed that developing countries did not need to develop their own research capacities.

The underlying logic was that, being science historically and socially neutral, then research results produced in the advanced countries could be just transferred to the developing countries and directly applied to the solution of the latter's technical problems. Coherently with such logic, and for the countries under the sway of Western liberal capitalism, modernisation theory, which advanced the thesis of unilinear development leading to industrialisation, provided the justification for funding assistance and Northern intervention in the South. Such intervention, at this time, took predominantly the form of extending technical assistance and the granting of a few scholarships. The latter derived from donors' realisation of the dearth of an organised and critical mass of intellectuals or academics with the training to analyse scientific needs for development. Since it was believed that the absence of this group hampered the internal development of their societies, donors also provided training fellowships that enabled students in the natural sciences, social sciences and the humanities in the South to pursue research or graduate degrees in Northern universities.¹ (Shinn et al 1997).

During the 80's, however, the neutrality of science began to be questioned and government resources even in the richest countries could not cope with the increasing financial demands from "good" quality science. This implied that choices had to be made to provide financial support to some research projects and not to others, despite all having similar scientific merit. The solution was to identify priority areas for research, which seemed to be linked to demands from society. This notwithstanding, the prevailing view of technological innovation was still a linear one, only that innovation was then seen as pulled by the market, instead of pushed by science. Since market demand was important to give direction to science, it was natural to expect that the "product-mix" of science in each country would be different, responding to local demands. Actually, bibliometric studies which mushroomed in the 70's and 80's gave considerable support to this idea and showed for example, that the former Soviet Union, the US and the European countries gave different emphasis to the various research fields. Such bibliometric evidence was assumed to reflect the different needs and demands from society in those countries.

The focus of North-South cooperation in this period changed accordingly so as to be coherent with the general prevailing paradigm and its constitutive concepts. The priority of Northern donors became to invest on the development of research capacities in the South in the fields that were believed to be most needed to solve local problems. And since markets in the developing countries, apparently, did not make explicit demands on local science, donors believed they should be the ones to identify the economic sectors and the scientific disciplines which should be given support. Coherent with this approach was the massive support to agriculture granted by all donors to the South.

This was a considerable shift in perspective and one that SAREC was fast to embark on. For example, in a joint brochure of their achievements in development research, SAREC and IDRC claim that while the ideology and practice of technology transfer assume that all technologies emanate from the North, they are to some extent dependent on the cultures and environments that create them. In reality, both agencies recognised that a great deal of innovation takes place in the developing world and thus, to build research capacity to support innovation is essential. (SAREC & IDRC 1991: 5-7). Nonetheless, the process leading to innovation was still believed to be a linear one whereby researchers must identify society's need, translate each need to researchable problems, work scientifically on them, disseminate the results to some kind of intermediary institution (a firm, a government institute, an extension organisation, etc) which would, then, make use of the results by incorporating them into an innovation. Only after this process the innovation would be transferred to the final user, or to "society".

During the 90's, evidence began to accumulate that the linearity of innovation was illusory. Studies in technology history, for example, provided clear evidence of the complex interaction between various

¹ The Ford Foundation, Rockefeller Foundation, Fulbright-Hays Programme and Colombo Plan, for instance, provided funds for a critical mass of future professionals from developing societies to pursue training in particular disciplines.

social actors in the configuration of a new technology. Thus, it became clear that it would be advisable, from a policy perspective, to foster the links between the various knowledge-producers and users (academy/industry/government/civil society organisations of all kinds) – stimulating the most varied types of alliances. Moreover, it was also realised that a distinction between knowledge producers and knowledge users was not always so clear-cut. Studies went so far as to suggest that society impinges not only on technological development and on the direction of scientific research but also on the contents of science itself. Despite considerable debate about the latter, the contours of a new paradigm of science and technology policy which paid attention to the preferences and participation of other social actors beyond the research community began to be delineated.

The whole process of technological innovation and of its impact on economic growth and quality of life also began to be more clearly understood. Evidence accumulated that the countries which have been able to develop a coherent national system of innovation have fared better in economic and social terms.

Such a system of innovation is seen as made up of actors – firms, government laboratories, universities, professional associations, grassroots organisations, etc. However, the most important element in the system is not so much the strength of the individual actors as the links between them. A national system of innovation made up of actors which are not particularly strong, but where the links between them are well developed, may operate more effectively (in term of learning and in generating innovations) than another system in which one or other actor is strong but the links between them are weak. Thus, according to this conception, it is not sufficient to make the research system strong if it has weak or no links with other parts of the system.

It is known that innovation increasingly takes place at the interface of formal research and economic activity, thus denying the primacy of either knowledge creation and validation institutions (R&D bodies, universities, etc) or knowledge application institutions or groups (usually enterprises, be then small, medium or large, or civil society organisations). Rather, it is **partnerships** between these types of actors which are important.

This also reflected in the discourse of North-South cooperation: participatory methods were introduced in the hope to identify the needs of local research “users” and to foster linkages between knowledge producers and knowledge users. The concept of capacity was expanded so as to include not only development of individual skills but also “the conditions that must be in place, for example, knowledge, competence, and effective and development-oriented organisations and institutional frameworks, in order to make development possible”. (SIDA 2000: 21).

As a matter of fact, in the case of SIDA, the discourse of North-South co-operation has completely adopted the new paradigm of the systemic approach to capacity development. After enumerating the various forms by which SIDA has supported the knowledge and human resources development in the South, a recent policy document produced by SIDA points out that: “What is lacking is a greater focus on systems and a systems approach. Human resources development is always needed, is always requested, and can always be justified. [É] Rapid technical developments justify *reviewing present forms of support for educational programmes*” (SIDA 2000: 23, emphasis added).

The document also argues that North-South institutional cooperation has been the predominant method to human resource development adopted by SAREC. However, in such type of arrangement, experience shows that what often happens is that different parties learn from each other in their own specialist fields. “This method does not often lead to development of organisations or to changes in the institutional framework which stipulates what the organisation may do.” (SIDA 2000: 23) More efficient support should contribute to develop and strengthen institutions and organisational structures as well as

to foster a process of interactions between those institutions and organisations in the public domain, in the private sector and in civil society (SIDA 2000: 9).

Having said this, the point I want to make is that SAREC's support to Nicaragua still adopts a linear model of innovation framework. Although, in *discourse*, SIDA and SAREC have adopted the systemic approach, the *practice* of the co-operation is still shaped according to the paradigm of the 80's. It is the adoption of such a linear model that explains, in part, the privileged support it grants to research capacity building in terms of Master and Doctoral training in the four universities. As this conception goes, society (the market, the civil organisations) will draw on the research results produced by the universities if and when necessary – all the universities have to do is to identify the needs of society and make sure that research results will be published and disseminated to those that may need them (this despite the fact that the evaluation mechanisms of the collaborations tend to value more the scientific publications than the communications with the lay public). The linear model suggests that the dynamics go from a source (new knowledge, new options) through its elaboration to eventual adoption, diffusion and effects on society. This is why the preference in this model is, first, to strengthen the research system.

Evidence of such underlying linearity in the conception of SAREC's support to Nicaragua can be found in a number of programme documents. As early as 1992, Olsson had already pointed this out as problematic and argued strongly in favour of a change towards a systemic and institutional approach. (Olsson 1992)

Despite of this, the dominance of the linear conception from research capacity to the solution of the problems of development is still noteworthy. For example, in the Terms of Reference for this study, it is asked the evaluation mission to: “describe the main areas of current research and the relevance of current research to the development of the country in the light of the aim to reduce poverty” (ToR 2001-06-12: 4(7)). No project in the collaboration was designed according to society's problem needs or to needs identified through strong links with other segments of society or with organisations. At most research problems were picked from broad general consensus problem areas. Thus, if the country has a high infant mortality rate by diarrhoea, the programme on infant diarrhoea is assumed to be relevant. It may well be that infant diarrhoea does not need any research to be solved – what it needs is other kinds of public policy, public services and income distribution. As we have seen above in the programme context, Nicaragua is the second country in the world with highest social and economic inequality. The same as far as viruses infecting tomatoes or coffee production problems are concerned. Of course if beans are the main staple food, and coffee the main export crop, then it is assumed that if the research is on beans or coffee, by definition, it must be relevant. But this is not automatic like that. For a piece of research on beans or on coffee to be relevant for agricultural producers, particularly for small farmers, the identification of the problem to be solved (as well as of the problem to be researched) has to be done in collaboration between producers and researchers. In most occasions it has to go much beyond the mentioned actors and also involve: commercial distributors of inputs for agriculture, farm equipment distributors, rural credit institutions, extension services, etc.

The same assumption of a direct relevant relation between the *topic* of a graduate research piece and real production problems appears in a number of reports from discussion groups during the evaluation workshops organised in the four universities for this study. Many pointed out that one of the strong points of the cooperation with Sweden via SAREC support was that *the research projects*

were relevant for Nicaraguan society. On the other hand, the reports of the 3 discussion groups during the evaluation workshop at UNA listed, as a negative aspect of the cooperation, the fact that: “the cooperation is too restricted to UNA”; “there is no dissemination of research results”; “there are no

mechanisms to evaluate the applicability of results”; “research results have not been useful to provide answer to [practical] problems”..

In a similar way, the general perception of UNA faculty members involved in the PhD training is that their research topic for the dissertation has the potential to contribute to the solution of some specific agricultural problem or may potentially generate knowledge or results of practical importance. Examples of such perception can be found in a number of declarations during the interviews, such as:

“Our main client is the small farmer. When I picked my research problem I had the small farmer in mind and I want my research results to be useful to him.”

“We are working on problems that are real in agricultural production in Nicaragua. This is what motivates me.”

“We need to solve practical problems. If we can solve problems with our research and at the same time get a good publication, all the better. But my objective is still to solve the problem”.

Despite the above perceptions of the social and economic relevance of *theses research topics*, there is a quite widespread concern among the faculty members interviewed with the fact that the research taking place at UNA has, so far, had a very little impact on local agriculture. When asked how they have reached such conclusions, a few of the interviewed researchers were able to provide indicators to support their assessment. They said that the *extension of adoption of technology generated by UNA* was very small, that there were very few (if any) *projects and agreements of UNA with the productive sector*, that UNA has not produced *manual and information leaflets* for the productive sector.

In the argument of the participants of the group discussion as well as in the discourse of UNA faculty members, the assumption of a linear process from the choice of a research topic, to the production of research results which are then disseminated to and adopted by users is evident. For then, the reason why the results are not adopted is not because the research project is not relevant, but because the results do not reach the farmers – it is, therefore, a problem of *communication*, or at most, of *extension*.

However, what the system of innovation framework proposes in this new paradigm is a non-separation between basic and applied (problem-solving) research, between knowledge producers and knowledge users. It has been clearly demonstrated in the most different contexts, including in Nicaragua “that applied research can go hand in hand with more fundamental research and also with community-oriented services that are research-based and can create new opportunities for the training of students through learning by doing”(Brunner & Eduards 1994: 72), even in the absence of favourable institutional conditions. A good example are some research projects at UNAN-León supported by Sarec which have had a considerable impact on health policy, being responsible for basic epidemiological information (EM-DR 2001).

The lack of impact of UNA’s research activity on agricultural production has been emphasised by outsiders. An interviewee who has long-standing close relations with UNA but is not part of the faculty there, said:

“UNA never had so many qualified researchers as it does now. But, I ask: in 20 years of collaboration with Sweden, what has been the impact of the UNA-Sweden collaboration on Nicaraguan agriculture/husbandry sector? I can say as a close witness that this impact is very, very limited, to say the least. There are no links between UNA and the production sectors.”

The same concern is expressed in the discourse of the Swedish Ambassador and of the SIDA officer in Nicaragua. In an interview to the evaluation team the former declared:

“A major concern of donors in Nicaragua is the role of the local universities to national development. The universities need to be more open to society’s needs.” (SWA 2001).

Despite this concern, it is not very clear why it is that SIDA, according to their officer in Nicaragua, is starting to fund a project to increase productivity in coffee and milk production with the Ministry of Agriculture and Forestry of Nicaragua and is “thinking to involve National Agricultural University (UNA) to see if UNA will open itself more to the public” (SWS 2001).

Why was it not the case that UNA was invited from the beginning, as one of stakeholders, to participate in the discussion and design of the project and also be involved in its implementation? To this question he replied “because they are too busy doing their dissertation research work” (SWS 2001)

A concern with the rationale for the Swedish support in Nicaragua according to which “a basic science platform is needed *before* it is possible to build up a viable applied research activity” (Hasselgren & Nilsson 1990:43 as quoted by Brunner & Eduards 1994: 71) has already been expressed earlier. Brunner & Eduards argue, in a similar way as I do here in this report, that this model “phase I basic research and then phase II applied research” “does not necessarily have to be understood in a mechanical way” (p.71). I totally agree with them that “the assumption that having some basic research will in itself reflect on better teaching programmes, will ensure appropriate education and training manpower, will give access to competent people in order to properly assess imported technologies and will enhance a country’s capability to define, evaluate and plan for research in general, is not to be taken for granted” (Brunner & Eduards 1994:71-72).

Although many times is not possible to have the institutional conditions right, such as a national policy for S&T, or a conducive environment for innovation (such as high economic investment), even then it is possible to support research capacity building which is not locked inside the university context and which tries to build partnerships with other segments of society.

At this point, it is legitimate to ask: By saying that the impact of the Swedish collaboration on solving development problems in Nicaragua (such as reducing poverty, according to the ToR) has been very limited, am I implying that the co-operation programme has *not* been successful?

My reply is an emphatic **NO**. The programme has been, as far as I can see, *very successful if assessed against the objectives it had*, that is, *building academic research capacity*. There is no doubt that the programme was able to do this. The achievements of the programme in this respect are outstanding, as indicated by the following evidence:

- the number of masters and doctors formed is significant as shown in Table 2. More revealing than absolute numbers, for some universities, is the proportion of Masters and Doctors trained under the Sarec programme in relation to the total. This is the case of UNA where 25% of the teachers who are MSc holders obtained their degree in the UNA-SLU co-operation programme. And, of the existing 5 PhDs in the university, 2 were trained with Sarec support (9 PhDs are supposed to finish by 2003, which will be a considerable increase). For the older and largest universities, the impact of Sarec programme in the formal training of researchers has not been so pronounced, but still important, as is the case of UNAN-León. In this university, of the 40 PhDs, 5 (8%) obtained the degree under the bilateral co-operation (including here the Graduate Programme In Biomedical Sciences KIRT/CA) and 9 faculty members are currently enrolled in PhD studies in Sweden. The impact of Sarec in the training of MSc’s in UNAN-León is of a similar magnitude – 8%, that is, 13 with Sarec support out of 170 MSc degree holders in the university.
- It may be argued that those enrolled in the programme take too long to obtain their degrees and this is used many times as evidence that the programme has not been very successful. It seems

reasonable to argue that degree completion time is not as long as many think, *relative* to other countries. A recent study for the US found that the average time for PhD degrees in that country was around 7 years (Baird 1990). The equivalent figure for the UK is 5 years for fully-dedicated and fully-funded students (OST 1998). For Sweden a recent study found that, in the social sciences from 1969 to 1996, “only one out of five doctoral students obtained a PhD, and it took this one, more than a decade to do so” (Frischer & Larsson 2000: 132). Even with the much stricter rules established by the National Agency for Higher Education in 1999 concerning admission to graduate studies in Sweden, it is expected that part-time doctoral students will take 8 years to complete the programme and obtain the degree (RRV 2001: 32).

- Taking the case of Nicaragua, for UNAN-León, for example, the average time for doctoral degree was 10 years for part-time students. Part time students in the social sciences in the US take an average of 13 years to complete (Baird 1990). For UNA faculty members, the average time for PhD so far has been 5 years. The time taken by the Nicaraguans to obtain their degree seem reasonable particularly given the circumstances under which the training takes place, such as: part time dedication to the graduate studies; moving countries every once in a while; leaving the family behind; having to build local laboratories, import equipment and put them to work before doing the research; having no financial incentive to obtain a degree; doing research in an isolated way and not being part of a research team; having communication problems with a far away supervisor.
- the faculty members involved in the Sarec programme have been able to train a significant number of undergraduate students in research, if it is taken into consideration that the incentives for undergraduates to do research is almost non-existent. Some relevant indicators are:
 - UNA has involved about 186 undergraduates in activities related to Sarec projects (UNA-SR 2001). Of course not all of those students decide to do their graduate work within the project, and prefer the exam option (as discussed in the section on the context of the programme, undergraduate students are increasingly preferring to take graduate exams than to do research or monographic work). Some of those involved in the projects do decide to write a research piece: in 2000, 14 undergraduates presented their dissertations under the supervision of the Sarec PhD candidates at UNA.
 - For UNI’s Faculty of Chemical Engineering, since 1988, 35 undergraduate dissertations were produced in the framework of Sarec projects and an additional 16 dissertations were directly supervised by faculty members who are part of the Sarec programme. The equivalent figure for UNI’s Faculty of Electrical Engineering is 14 undergraduate thesis produced.
- Research laboratories have been built and equipped in the 4 universities as result of Sarec’s support. Although some of them, such as the Chemical Engineering one, are not a planned lab, but more a collection, put together in the same space, of equipment needed for the different students’ thesis work, others have been established with longer term concern. For example, the laboratory facilities of infectious disease programme at UNAN-León are considered to be “the best in Nicaragua”(EM-DR 2001: 4).
- In the case of UNA, the recently created molecular biology laboratory, although “being too small for running courses [É] will be used to train UNA faculty members and students to the molecular marker techniques” (Valkonen 2002). Talking about the importance of those labs for creating a research environment at UNA, one of the interviewees said that “without the Swedish collaboration we would not do research. The university only pays our salary”. Without disputing

the relevance of Sarec support to establishing the labs, it is important to point out that statements such as the one just quoted¹ show a lack of awareness of local faculty members of the amount of public resources that go to fund universities in a poor country like Nicaragua. As explained in the context of the programme, 6% of government revenues are channelled, without discussion and negotiation by the National Congress, to fund 10 public universities (UNAN-Managua; UNAN-León; UNI and UNA together receive about 73% of such resources). In addition, universities are exempt from all kinds of taxes, and from paying infrastructure facilities bills. All this comes from public funds. Therefore, university officials need to raise awareness among its faculty members and students of the meaning of the resources that go the HE in Nicaragua. When contributions to lab facilities are identified, it is paramount to make clear how much public funds went and are mobilised to make the labs operational.

- Another important result of the Sarec programme in terms of stimulating a research environment at the universities was the establishment of research councils” – competitive funds to support small projects, participation in conferences, organisation of scientific meetings, which are open to the whole university community and not only to those faculty members who are directly involved in the programmes. Despite functioning with very modest funds, the research council, in some cases, have created specific lines of support (such as the support for young researchers at UNAN-León) from which Sarec has overdrawn its support and the universities have financially taken over. This indicates that the universities do have some room for manoeuvre with their budget and that, when there is sufficient incentive and community support, investment decisions may be in the direction of supporting research activities. Certainly the awareness of the university community, as well as its support to investment in research, may be, at least in part, attributed to the Sarec programmes in those universities. Actually, a consistent outcome of the discussion groups in all universities was that the Sarec programme has had an important role in raise a internal appreciation for research activities.
- A significant (yet unplanned) impact of the Sarec programme, and one that is considered by some as a loss, is the fact that some of the faculty members trained under the framework of the programmes left the universities. This is the case of 5 MSc from UNA: except for one who passed away, 3 work for the Ministry of Agriculture and are important links of government to UNA. A similar situation took place at UNI: 5 faculty members who had already obtained their Licentiate degrees left the university to the private sector to companies such as Café Soluble (instant coffee), Esso (oil refinery), and the Sugar cane factories. “In these companies, former Sarec students (Lic. degree) hold significant posts, as for example Director of production/process quality. In the case of Café Soluble, the two former Sarec students have played a substantial role in improving the product quality, including an ISO 9000 certificate, as well as increasing the export market for its products. The Café Soluble has also received BSc student for thesis work in several occasions” (TA-DR 2001).
- The programme has also contributed to capacity building of the Swedish counterparts: 12 master students from Sweden did their dissertation in Nicaragua in the framework of the programme in Chemical Engineering from 1994 to 2001. In addition, 2 undergraduates from the Swedish KTH did their dissertation research in Nicaragua, Faculty of Electrical Engineering, UNI (UNI-SR 2001). No consolidated information was given by the programmes in the other universities, but it was mentioned in the interviews that a number of medical students from Umea did research work in Nicaragua (and that they used programme resources for that, what, it was said, was not supposed to happen). In the case of UNA it was also mentioned that a Master student did research work in Nicaragua under the supervision of one local faculty member who is a doctoral student in SLU.

¹ A similar statement is quoted in Brunner & Edwards (1994: 67): “we survive on the budget of the state, but it is the foreign support that enables us to develop our university”.

- Nicaraguan faculty members enrolled in the programme have not only carried research , but also published the results in refereed journals, frequently as first authors (as discussed above).
- Libraries and access to computer facilities have improved, the same in relation to research management (purchase and import of research equipment) as result of Sarec support

All results presented above were said, written and emphasised in the reports of all groups in the workshops, may be inferred from the documents and were explicitly mentioned in the course of the interviews. I have no doubt in stating that the Sarec programme has been very successful in doing what it meant to do: build research capacity, more specifically individual research capacity in terms of qualifying university faculty members to do research and to give them conditions to carry out their research work. In the course of doing that, others colleagues and undergraduate students benefited from the resources allocated.

Therefore, if Sarec believes that by creating this kind of research capacity it will, sooner or later, contribute to the development of Nicaragua, then the future co-operation needs only to be adjusted so as to solve a few practical problems (such as establish a more competitive and efficient mechanisms for selecting new PhD; solve the gender bias; and other things of similar nature) and continue in the same track.

But, on the other hand, *if SAREC wants the collaboration to have a direct impact on development, the future collaboration will have to be devised in a very different way and not concentrate only on Master and PhD training and on building a research environment at the Nicaraguan universities.*

Various suggestions in this direction appeared during the interviews. For example, in a joint conversation with faculty members from UNA, it was said:

“We now have our house in order. We want to contribute more to solve real problems of Nicaragua. We need to build closer contact with farmers associations. We are planning to do this using participatory methods. We would like SAREC to support this activity”.

“It is not only farmers and agricultural producers and ONGS. I think that our links are very weak with policy-makers as well. We need to have a more pro-active role in terms of interacting with government and thus participate in macro-level decisions and priority setting concerning agriculture. But we have no experience in doing that – we have to learn how to foster the necessary links.” (UNA-RP 2001)

In a similar vein, a consistent suggestion coming from researchers both in Sweden and Nicaragua was the need to make SIDA's and SAREC's actions in Nicaragua more coherent and complementary so that the research system could be integrated to development programmes and actions. It is quite clear to all involved that the amount of SAREC's financial support to the universities is not sufficient to fund a much broader programme involving other institutional actors. However, SIDA could be brought in the process and, together with SAREC be willing to provide a support devised in terms of innovation systems, fostering links among actors towards an envisaged end. A specific suggestion in this direction came from experienced Swedish participants in the collaboration, one of whom expressed himself in the following words:

“Actions funded by SIDA in Nicaragua are of a social and economic order. The ones supported by SAREC are scientific. They not always go in the same direction. SIDA should work together with SAREC. For example, SIDA could tackle the complex issue of funding projects to improve technical conditions of the hospital in León. Without a considerable improvement in infrastructure routine in the hospital (register of cases, database collection, laboratory sample

collection, standardisation of diagnostic kits, etc), even the quality of the research work performed by the university (UNAM-León) suffers. The point is that the hospital is not part of the university, but still the university depends on the hospital for sample collection for the research they do. Because the hospital is not part of the university, it does not qualify for training under the collaboration (besides they have no interest in PhDs). But, SIDA could support the hospital” (SMI/IMPI 2001).

What is being suggested, then, is a systemic approach to research and hospital routines and that this could be jointly supported by SIDA and SAREC.¹ Actually, the need to integrate SAREC’s and SIDA’s activities have been stressed in the reports of all evaluation missions to Nicaragua from the early 90’s. Brunner & Edwards (1994: 78), for example, call attention to the need to co-ordinate SAREC’s programme at UNAN-León with SIDA’s support to the Silais structure. It also points out the desirability of strengthening links with MINSA and with PAHO and UNICEF, adopting a systemic approach. In the same year, a specific evaluation mission to UNAN-León stressed that “collaboration with SIDA is needed on several issues” and goes on to explain where and by which means (Allebeck & Nieto 1994: 42). It is, this difficult to understand why steps have not been taken in this direction.

I believe that a shift in the collaboration in the lines suggested above, that is, using a systemic approach is needed, if impact on development (poverty alleviation) is desired. Let us move now to discuss the second assumption which, as my analysis goes, lies on the conceptual basis of the support of SAREC to the universities in Nicaragua.

iii. Formal Graduate Training of Faculty Members

As said before, SAREC’s modality of support not only emphasises research capacity building in the academic context, but also gives a privileged attention to the training of faculty members in formal Masters and Doctoral programmes.

The emphasis on research training was recommended by an independent review of SAREC that took place in 1985 (SIDA 1998a: 28). At this time, as described above, the linear model of innovation was still quite dominant. Therefore, it is to be expected that a recommendation to build research capacity through formal research training would be seen as a necessary pre-condition to technological change and, consequently, to help find solutions to development problems.

It is reasonable to assume that the rationale underlying SAREC’s decision to place great emphasis on formal academic training was that researchers with MSc and PhD degrees are a pre-requisite to academic research capacity in the universities.

Without disputing this in a general way, I do want to argue that there is no evidence that the number of Masters and Doctors and the number of papers published in refereed journals are in any way related neither to economic growth nor to human development index as far as the developing countries are concerned.

Brazil and South Korea are two very good examples of this: while Brazil has a larger number of researchers with formal degrees and publishes a higher number of scientific papers than Korea, the latter fares much better in terms of technological innovation, economic growth and human development index. There are a number of reasons for that which are not relevant to discuss here, but

¹ Mention should be made here that, according to E. Moreno who has looked in detail the case of UNAM-León, it seems that all research programmes at that university were able to integrate their activities with the community of León and to build important links with MINSA (EM-DR 2001). This, however, was built on the interviews with UNAM-León faculty members only. Further investigation into community’s perception, MINSA’s perception and other impact indicators would be desirable to get a view from the users.

what is pertinent is the fact that the scientific workforce in Korea works in close connection with other institutional actors, have learned to work in partnerships, are trained in research by working with other researchers.

Similarly, in Japan, it is quite common that private companies send their researchers and scientists to PhD programmes in the US only for 2 years or so: to take some advanced courses and to learn special techniques and to learn how to work as part of a team. After 2 years, they return to the company: it is not the degree that interests them, but some specific lessons, work routines and contents that they can get from the courses. It is mostly *tacit knowledge* that they are after. What is this?

Scientific knowledge is created by a combination of codified (explicit) knowledge and tacit knowledge (Polanyi 1958). Codified knowledge is contained and transmitted by books, articles, manuals, reports, etc. Tacit knowledge, on the other hand is experience, personal skills, attitudes and scientific craftsmanship (Collins 1995). The idea is that to obtain tacit knowledge, one has to work close to those who possess the knowledge, since it is not transmittable through codified sources. Japanese companies long realised that the only way they could get hold of certain specific skills, routines, methods, etc was by having their skilled personnel trained in the research centres and universities they identified as having the desired knowledge (Nonaka & Takeuchi 1995)

Thus, it seems to me that the insistence of SAREC on the faculty members been granted formal degrees, even in the cases that those are shown as unnecessary for the research performance of the faculty member, is misplaced. This creates a sense of in-debtness and anxiety from all parts when the degree is not granted in the expected time (that is what is happening now) and spreads the notion that only those who have the degrees are entitled to be called researchers.

In UNAN-León there are quite a few cases that illustrate this point. At least 2 PhD candidates have been enrolled in doctoral programme for more than 10 years. They have become very skilful and experienced in research to the point that they have published consistently in refereed journals. As E. Moreno says in his report about UNAN-León, “considering that some of the senior graduate students are already consolidated academics at UNAN-León, who are working in or leading research groups, their absence may cause more problems then benefits to the system” (July 2001: 12). In other words, SAREC has insisted that those graduates finish their degrees and has even conditioned further support to their doing so. But the degree in their case is a mere formality: they are already recognised researchers. Meanwhile, important financial resources who are set aside for the continuing enrolment of such graduate students in Sweden could be used to train a number of younger faculty members in other countries.

PhD research work is not the most efficient manner to stimulate team work in the conditions of developing countries. In the advanced countries, PhD candidates usually work under the leadership of a professor who has a broad conception of a problem, who promotes weekly or so discussion groups and make students see the connections among their work. However, when the Nicaraguan graduate student has to do a thesis in the conditions of his/her own university, being the only person working in the topic, this is a very isolated activity and does not promote team work. A few interviewees made this point clear.

Another associated point is that a Nicaraguan enrolled in doctoral studies in Sweden and doing research work in Nicaragua has little opportunity to acquire tacit knowledge. As pointed out above, this kind of knowledge is transferred and acquired by physically participating in the demonstration and instruction of those who possess this knowledge. “This stresses the importance of a close interpersonal relationship in [doctoral] supervision” (Frischer & Larsson 2000: 151). This kind of relationship is very weak for many of the interviewees who have to carry out their research work in isolation. It seems to be

in part to counteract this absence of the Swedish supervisor during the research in Nicaragua that E. Moreno talks of the importance of the “close sandwich model”, whereby the doctoral candidate has a supervisor both in Sweden and in Nicaragua.

Moreover, it is well known that not every research topic makes a good PhD dissertation topic. During a collective interview with SLU professors and researchers involved in the cooperation with UNA, when the question on how research problems are chosen for dissertation work was asked by the team leader, the reply was:

“the areas of research and the candidates are proposed by UNA. However, we at SLU have a final word accepting or not the proposed candidates and the areas. We have had no problems with the proposed candidates but we do have changed proposed research topics when we believed that it would not be feasible or interesting for dissertation research”.

Although there is no doubt that relevant research has to be of acceptable scientific standards, not all relevant research attends the scientific requirements for a PhD. Thus, by granting support to PhD thesis, the SAREC programme is, in a way, making graduate students pick up their topics more by scientific than by social and economic relevance criteria.

It is interesting to note that one experienced Swedish researchers at KI said:

“SAREC was the one to decide that the goal of the co-operation was to make PhDs out of the faculty members of UNAM-León and that those PhD degrees had to be granted by Karolinska Institute. Now we are trapped: the Nicaraguans have to follow the rules in terms of publishing a certain number of articles and in certain journals. And the conditions under which they have to do this are not the most favourable. Besides, I am not sure that this is the best for them”.

And finally, it must be said that PhD degrees serve a clear function in the advanced countries: they indicate that someone has been through a specific training period, carried out research work, and is, therefore, able to perform research. This is an important “market” indicator and an entrance requirement for positions in academic settings and some industrial R&D labs. However, in the case of Nicaragua, and specifically for those faculty members enrolled in the programme, the PhD title has no functionality: they are already university teachers and they are not promoted for obtaining the degree.

To summarise the argument, although research capacity is essential for Nicaraguan universities and also for contributing to development, it does not seem to be the case that PhD and MSc training is *the only* or *the most appropriate* and *efficient* way to achieve it. Without advocating for a termination of support to PhD training, and even recognising that in some cases it may be appropriate, I do believe other forms of research training should be devised and implemented with SAREC support.

Examples of those are: tailor-made courses for small groups followed by collaborative research in topics identified as important for local production; collaborative research of all kinds (among researchers, with the private sector, etc) under the leadership of more experienced researchers; regional collaboration; short training and courses in topics or techniques that are identified as necessary, visiting researchers from other countries for specific activities, etc. Because these training formats are not the conventional ones, the mere suggestion of them seems to be “superfluous [sic] and too generalising”, as one SLU professor accused me (Mattiasson, 2002). But I believe it is not for me to propose a close solution or alternative. This has to be thought and devised in relation to the identified needs of the universities.

As a matter of fact, there are examples in Nicaragua of institutions who are pursuing innovative paths to train researchers, namely, NITLAPAN (at UCA) and ADESO. An exchange of ideas and practices with such institutions could be valuable for the universities. In addition, it is worth mentioning that a

close association and partnership between UNA and NITLAPAN has been strongly recommended by SAREC evaluation mission in 1994 and has never been implemented (Brunner & Eduards 1994: 79).

In short, if SAREC really wants to support research capacity building that is of high quality *AND* at the same time is relevant for the country, promote a participatory discussion centred on this topic involving experts and stakeholders. It is very important to let the Nicaraguans themselves decide what kind of training they need and want and do not decide beforehand that what SAREC will support is Master and PhD training *only*

Finally, underlying SAREC model of research capacity building in Nicaragua is the assumption that Master and PhD training should take place in Sweden (until Nicaraguan universities are able to reproduce their own researchers) and adopt the sandwich design. This assumption will be discussed in the next section.

iv. Graduate Degrees to be taken in Sweden and the sandwich model

In the modality adopted by SAREC, Master and PhD training is to take the form of a sandwich programme with the degree being granted by a Swedish university. One underlying motivation for this choice seems to be to involve Swedish researchers in collaboration with Nicaraguans and thus foster links between the two communities and build capacities in both sides. Other motivation, specifically as it relates to the sandwich model, is to avoid brain drain. As the argument goes, if the students do the research in their home country, it is more likely that they will work on a topic of relevance to the country. Moreover, they do not lose contact with their reality and are more prepared to face the research conditions they will encounter when returning home after getting the degree. An additional, and important, point is the contribution to foster an institutional research environment because laboratories are built in the Southern institution for the researchers doing their thesis work, and thus other faculty members and students may benefit.

Despite well-intentioned (and despite relative success), the above motivations are not sufficient to justify an universal model and to exclude other options. Why this is so?

Let's take first the point of the degrees having to be granted, almost invariably, by a Swedish institution. It is not always possible to force the interest of the parts and one has to be aware when such interest is not arising. The collaboration of UNI with KTH, for example, is not something the latter has put much interest on. This was clear in the interviews with both sides. In the electrical engineering case, for instance, the Swedish supervisor said clearly that he does not like to go to Nicaragua, and that this collaboration is very low in his priority list. Besides, the Nicaraguan counterpart in the collaboration does not really need Swedish supervision in order to carry out his research interests – he, the Nicaraguan researcher in case, is a very experienced researcher, with a former research degree in the Netherlands, who has created a research team inside UNI, able to bring in external financial support, despite not having yet obtained his final degree at KTH (which may well be an indication that one does not need a degree to be a highly qualified researcher).

The chemical engineering programme is another case in point. All graduate students in this programme are supervised by the same and only Swedish faculty member. This person is a very dedicated supervisor, who pays a lot of attention to the students and often goes to Nicaragua (once a year) to keep track of how they are working and supervise them. However, there was consensus among all 8 Nicaraguan students working under his supervision that he is the *ONLY* faculty member with whom the students have contact when they are in Sweden. They do not attend seminars or participate in discussion groups at KTH and do not take part in any other activity, they do not have Swedish colleagues and do not interact with Swedish students at KTH in any form. According to the students,

when they are in Sweden they only take courses and do activities related to their thesis and, even more distressing, even course work many times is difficult because some are cancelled at the last hour and there is no offer of discipline in English that can be of interest to them. Of course, in such circumstances, some of the students have no pleasure (even academic pleasure) in spending time in Sweden and, consequently, it is obvious that their research will suffer and the time to complete the degree will become longer. Also, in such circumstances it is clear that there is no contribution from KTH to build a research environment at UNI.

The two cases above are illustrations of the fact that the bilateral cooperation (with the idea of fostering links between research communities in Nicaragua and in Sweden) can be merely ritualistic – each partner is following his/her own paths and interests and what holds them together is the requirement of the degree to be granted by a Swedish institution put forward by SAREC and, obviously, SAREC financial support. It must be borne in mind that even if the collaboration does not work so well, still a considerable proportion of the budget of this programme stays in Sweden, as shown in Table 3. There it can be seen that even if KTH as an institution puts so little effort in its collaboration with UNI, it still keeps more than 50% of the budget destined by SAREC to this programme.

Table 3. Percentage of the SAREC's financial support that is managed by the Nicaraguan Universities (the remaining part up to 100 is administered by the counterpart universities in Sweden)¹

	1998	1999	2000	2001
UNAM-LEON	49	45	44	40
UNI	39	49	50	40
UNA	47	36	42	41

Source: Asdi 2001 (Appendix II)

With the amount of financial resources which are paid to KTH to train Nicaraguan researchers, a much larger number of faculty members from UNI could be trained in Latin America, visiting professors could be hired with a greater multiplying effect for the university, collaborative research projects with the productive sector could be funded, etc.

In order to revert this situation SAREC has to decide what is the main motivation for its support to universities in Nicaragua: the building and strengthening of local research capacity that may be relevant for development *OR* fostering links between Nicaraguan and Swedish research communities. If it is the former, SAREC could consider drop the requirement of degrees being granted by Swedish institutions (it has for a few MSc degrees, but not for PhDs, despite paying for the students taking disciplines in US universities and in other countries).

Actually, the issue of being more free to choose where to take their advanced degree was a common suggestion in the discussion group reports, and also in the interviews in all universities. Concerning UNAN-León, E. Moreno, reporting on the interviews with project participants in the infectious disease programme points out that for all three projects – infant diarrhoea, antimicrobial resistance and bacterial antigen – participants expressed that “they would appreciate more autonomy for selecting their counterparts, since sometimes the expertise they require is not in the laboratories where they were sent for training” and that “they believe that some training would be better achieved within CA or in other Latin American countries, such as Brazil or Mexico”(p. 4-6). The same idea is widespread among participants in the public health programme as well, so that E. Moreno concludes that “it seems to be a consensus that some training could be performed within the regional programs in CA and LA” (p.4).

¹ Comparative data for UNAN-Managua was not available in the documents provided by SAREC to the evaluation team.

The same kind of statements and wishes about more autonomy for choosing where to go for graduate studies were expressed by a number of interviewees both at UNA and UNI (I did not do interviewing at UNAN-Managua, therefore I do not know whether this holds for that university as well). And, actually, former evaluations have already made the point that it makes much more sense, for a number of research fields, to establish training programmes for Nicaraguan researchers within LA (see Brunner & Eduards 1994: 78).

As a final point concerning the division of financial resources between Nicaraguan and Swedish universities, it should be remembered that SIDA has established a special programme to promote Swedish development research, namely the SIDA Development Research Council. The latter funds development relevant research projects on a competitive basis for Swedish researchers only. Development research is also invited by other SIDA departments to Swedish universities. The amount of resources allocated to these programmes is not insignificant. For example, for the year 1999, an overview of SIDA research funding in relation to different programmes shows that bilateral programmes (of which the co-operation Nicaragua-Sweden is part) received 28% of the total SIDA's research funding budget, whilst support to Swedish development research received 10% of that total. (SIDA 1998a: 33)

The point I want to make here is that Swedish researchers do have special funding opportunities to build their development research capabilities as well as their international co-operation capabilities. It just does not seem appropriate that Swedish universities keep over 50% of the resources destined to build research capacity in the very few countries that qualify for this kind of support. While in 1999 only 8 countries had active bilateral research programmes (Eritrea, Ethiopia, Mozambique, Tanzania, Zimbabwe, Sri Lanka, Vietnam and Nicaragua) supported by SIDA, more than 130 institutions (departments) at Swedish universities and colleges were participating in programmes of bilateral research co-operation. (SIDA 1998a: 33).

Despite such strong involvement of Swedish institutions and researchers in bilateral co-operation, for the purpose of this evaluation mission I could not find any reference in the documents received from SAREC to capacity building in Swedish universities as an outcome of the co-operation with Nicaragua. It seems to me that Swedish participants in the programme are not required to reflect on the benefits that enrolling in the co-operation brings to them.

The Sandwich model: should it be the “universal model”?

When SAREC made its change of emphasis from channelling funds through national research councils of the developing countries to support research training (as recommended by the independent review of 1985), they decided for the adoption of what became known as the “sandwich model”. “This model requires doctoral students to be active in their home institutions and only spend short periods of time abroad. The training takes place within the framework of a project carried out at the home institution”. (SIDA 1998a: 29)

The reasons put forward by SAREC to institutionalise the model are: it avoids brain drain and, since the research training is based at home, it is combined with support for research facilities, thus helping to build local institutional capability in terms of laboratories, equipment, library support, etc. It is also believed that this would help to foster a local research environment and thus help to pave the way to develop local research training programmes at the local universities.

Among the interviewees both in Sweden and in Nicaragua, the general feeling is that the advantages listed above do hold in many cases, but they are not to be taken for granted and they must be weighted against the limitations of the sandwich model. The list of limitations, compiled from the interviews,

from the literature and from my own assessment seems to be quite long.

First, to obtain the PhD degree in the sandwich model takes longer, by definition. The reason is that it is clearly a *part-time* enrolment for the PhD. The recognition that the sandwich model is a part-time PhD training is clear only in a few of the documents related to this programme. For example, a document of the Department of Ecology and Crop Production Science of SLU clearly states that “[PhD] studies are carried out on a part time basis; normally 80 per cent of full time, sometimes less” (SLU 2000: 2). This part-time character of the training is many times forgotten by evaluators as well as by donors.

Even if the researchers in their period in the home institutions have a lower teaching load, they still teach, attend department meetings, supervise undergraduate students, and have institutional duties. Actually, some of them even have high administrative positions such as head of departments, deans of faculties and even rector. Although it would be desirable that those enrolled in the programme would not take such positions, given the highly politicised culture of Latin American universities in general, and of Nicaraguan one, in particular, it must be considered that by having research committed people in such positions is a good thing to guarantee a research environment. Therefore, this is a reality of Nicaraguan universities which cannot be ignored or circumvented by the creation of rules.

Second, the sandwich model requires students to have periods of adaptation to and from: even if one is getting back home, months away ask for catching up time in domestic and university matters.

Third, being away from the family is not easy for those who go and even worse for those who stay, requiring considerable negotiation within the family and emotional effort from all involved. Also, it tends to be easier for men to leave than for women, as the low percentage of women participating in the programmes indicates (UNA is a particular case in point where only 2 of the 22 MSc degrees were received by women and only 1 of the 12 PhD candidates is a woman).

Fourth, the sandwich programme makes much more difficult for the students to work as part of a team while in Sweden and to participate fully in the academic life there. It also restricts the experience and opportunity to acquire tacit knowledge, as discussed above.

Thus, even if the long period for PhD completion is normally attributed to weaknesses of the Nicaraguan university system – to excessive teaching load, lack of financial incentive to those who have a PhD, difficulty to purchase equipment, university politics, etc- without denying that those factors do play a role, I believe that the reasons for the delay should be looked for in the intrinsic limitations of the logic and functioning of the sandwich model.

In view of that, I believe that it is for the Nicaraguan participants to decide if, even with the limitations pointed out above, they still believe the sandwich model to be a good model in particular occasions. But, probably, this sandwich model *does not* seem suitable as a *model for all occasions* (the universal model).

The issue of Programme ownership, asymmetry and relation with the Swedish counterpart

Ownership of the programme is, in my opinion, SAREC's. They devised the main features of the bilateral cooperation and the Nicaraguan universities together with the Swedish institutions have implemented it according to the requirements.

An evidence was given during field work at UNAM-Leon. In a collective talk with the participation of the 3 team members, the rector and the vice-rector as well as the SAREC programme co-ordinators, it was said by one local, with the agreement of the others, that:

“there was no discussed process to select the research lines to be pursued by the cooperation. They were picked up somewhat randomly and increased by inertia. Last year we presented SAREC a new project, a product of a long internal process which involved all university teachers. This project was a change in current cooperation research lines and SAREC’s reaction was: No new line, no new student. The reason stated was that cooperation money for Nicaragua had decreased. What we wanted with the new project was a qualitative jump to our projects, giving them internal coherence, abandoning the theme of infant diarrhoea which we have been studying in the last 20 years and look at problems which are really important for the local population such as “dengue hemorragico” – SAREC did not let us change the project, nor add new students, nor change the Swedish counterpart”.

In a similar vein, in a collective talk of 2 evaluation team members with 8 Swedish researchers of Karolinska Institute one of them stated that:

“SIDA is not very consistent in its ideas and often does not know how to interfere in the projects. Sometimes they think that they can even select the Nicaraguans who will participate in the project; other times they fail to perform what is to be their main role, namely provide basic information, in due time, of how much money we will get and when this money will arrive. Without this information we cannot plan anything.”

The situation in Nicaragua is such that SAREC’s is the only long-term support for research at the 4 Nicaraguan Universities. Some of them, such as UNAM-León, have other sources of support, but they are marginal (EM-DR 2001). In these circumstances, Nicaraguans have not much bargaining power to negotiate with a donor offering a more or less closed package whose core component is PhD and Master sandwich training for faculty members with at least 50% of resources staying in Sweden.

In addition, as the core of the collaboration between Nicaraguan and Swedish universities takes place in the form of Master and PhD training, it is, by definition, asymmetrical. There can be no symmetry in student/supervisor relation: student is the one who learns from the most experienced, namely, the supervisor.

Under the two conditions above, it is very difficult to conceive the possibility that the relations between Nicaraguan and Swedish universities will be symmetrical to any extent in the short term. Thus, even if most of the interviewees insisted on the fact that the relations were horizontal, there is considerable evidence to the contrary.

For example, most of interviewees in Sweden referred to the Nicaraguans in terms of “many lack sufficient theoretical background”, “their English is not good”, “they are hard working”, “they have evolved from sample collectors to researchers”, “they have docile attitudes that are difficult to interpret”, “if x were a Swedish student I would already had abandoned him”. These are not collegial statements.

In some universities even the place where the students will live when in Sweden is decided and paid for by the Swedish counterparts, with resources destined to the Nicaraguan students. And many times the living arrangements made are far from satisfactory for the Nicaraguans. Those who told me this were very reluctant and uneasy to say so, as if they were “betraying” the trust of their Swedish counterparts. This is certainly not a symmetrical feeling.

A number of interviewees and group discussions called for more autonomy for selecting tutors and for budget distribution (EM-DR 2001: 4-7). Recent studies have shown that heavy dependence on donor’s support, with related underfunding by local government, have considerable impact on programme ownership (Godfrey et al 2001). In the context of the project as described here, where SAREC’s is

actually the only substantial and long term research support on which the universities can count, it is not surprising that Nicaraguan partners negotiate from a weak position and are willing to accept whatever is offered. Repeating what one of the rectors said to the evaluation team:

“SAREC is the only significant source of research funding. Under these circumstances, any contribution we receive is important and we have to do what we can in order to guarantee its continuity”

Of course I am not implying that this cannot change in the future. As a matter of fact, it was the case that Nicaraguan programme co-ordinators have consistently stated that “Now we know the rules”, “Now we have begun to have a more pro-active position concerning decisions”, “Now we know how to relate with the Swedish counterparts”. There is, however, a long way to go before relations become really *symmetrical*.

From the above, it seems that Nicaraguans have to face asymmetry at two levels: in relation to the Swedish counterparts who, by being supervisors are, naturally, in an authoritative position; and in relation to SAREC who, by being the only long-term research supporting agency, negotiates from a strong position and has an almost unlimited decision power.

It is well known that local ownership is not something to be passively awaited. It needs to be nurtured by local project participants and university officials, as well as by donors. One way whereby donors may nurture ownership by Southern partners is by actively and directly involving them in evaluation exercises. It is important that the Southern partners are the ones identifying their “success and failure stories”, helping to understand what works, why and how, and ensuring that policies and further planning could build upon the experiences gained. This is important to allow Southern partners to “acquire not only a positive spirit about what [they] have been able to achieve, but also the improved capacity to analyse policies and practices, with a view to consciously promoting an ‘endogenous’ approach to problem-solving – as opposed to the entrenched ‘exogenous’ approach long since promoted by the donor agencies” (Hoppers 2001: 467).

In the specific case of this evaluation, even if a participatory approach was envisaged and Nicaraguan partners were active participants in discussion groups and report workshops, actually the whole evaluative exercise took a Northern (the donor’s) interest as a starting point. Consequently, the evaluation was conducted under Northern supervision and on the basis of research questions designed in the North. A Southern-centred approach would give the Nicaraguans the possibility to ask their own questions and make their own recommendations.

V. Conclusions and recommendations

The analysis presented here has developed the argument that SAREC’s programmes to build research capacity in Nicaraguan universities have been very successful, when assessed in relation to its own objectives, that is, building academic research capacity, particularly individual research capacity of faculty members. To support this assessment, a number of indicators were provided such as number of MSc, Licentiates and PhDs; articles published; improvement in the conditions of laboratories, libraries, ICT facilities.

It is, actually, remarkable, how much was achieved in terms of building research capacity in Nicaraguan universities in light of the social, economic and political difficulties faced by the country in the last 20 years. In circumstances where most of the institutions do not function well, the fact that the universities were able, not only to perform their functions but also to achieve the results presented here is very laudable. In this respect, the role of SAREC as donor and facilitator was of major importance.

Having said that, it is important to stress that part of the achievements of the SAREC programme, as well as of the continuing functioning of the universities, must be attributed to the fact that the universities receive, by law, a fixed proportion of 6% of government revenues, plus additional funding for major buildings and reconstruction, plus exemption of all government taxes and utilities bills. This, of course, is in detriment of other spheres of public spending. In a country where 50% of the population live below the poverty line and 19% in extreme poverty; where only 70% of those in the relevant age group are enrolled in primary education, 33% in secondary education and 12% of the 20 to 24 age group is enrolled in higher education, the commitment of a fixed proportion to universities is a demonstration of the priority given to higher education (and research, since most teachers are full-time and expected to do research) in the country. This is true even if the budget of the universities is not enough to pay compatible salaries and to fund research activities as desired.

In view of the effort that is asked from society to fund the local universities, it is expected that the latter will contribute to local development by training qualified human resources and producing relevant knowledge. In order to do these, it is possible to devise different strategies or modalities. The argument developed here is that the strategy that sees the need for a basic research capacity as pre-condition to a closer involvement of the universities with local society, needs revision and should not be taken for granted. It is also argued that SAREC modality of support is based on such a linear assumption. Therefore, it is suggested that SAREC revises its programme so as to design its support on a systemic approach.

V.1. Facilitate processes for building links among different institutional actors: government, universities, firms, producers associations, NGOs, grassroots organisations. For example, by funding a series of foresight/scenario building workshops by sector, involving the whole range of stakeholders in order to create a common language among stakeholders, build coalition, foster linkages. Remember that this type of exercise is as (and perhaps, more) process as (than) results oriented. There is today a cadre of specialists in organising, promoting and facilitating this kind of workshops.

V.2. Change the core of the SAREC support from Master and Doctoral training to foster local research capacity in

partnership among local (public and private) institutions (collaborative projects) – use the bulk of the resources to create opportunities for the local researchers to present research proposals in partnerships with productive sector, and with each other. This may well create the needed links between the nodes of a future innovation system.

Suggestion in the direction of fostering linkages among local social actors have long been given to SAREC and, for reasons not spelled out, have not been adopted. The report by Brunner & Eduards (1994: 79), for example, gives a list of partners who should be brought together in the case of SAREC support to UNA, such as IRENA and UCA, and also in the case of UNAN-León, such as MINSA, PAHO and UNICEF (p.78). It is quite clear to those visiting the universities, evaluating SAREC programmes and knowing the conditions of Nicaragua that it is essential that the effort made by all those involved need to revert on benefits for the whole society.

And, as I have argued extensively in the course of the analysis, one should ask whether research projects which are primarily designed with the objective of leading local faculty members to obtain their MScs, Licentiate and PhDs, are the most appropriate way to build the needed development-relevant research capacity.

V.3. Instead of one marginally funded research council per university, facilitate a process to create a single and substantive Research Fund in the country. A number of interviewees suggested this and

added that SAREC could co-ordinate an action in this direction among like-minded donors and, together with local stakeholders, cut a deal with local government to also contribute to the fund.

Actually, such a suggestion is part of the attributions that SIDA has taken to itself, as the following quotation from an official publication illustrates: “[SIDA will pay particular attention to] the facilitation of developing countries’ co-ordination of external research allocation, and in particular, their co-ordination of university support” (SIDA 1998a: 16-17).

V.4. Leave the decisions of what strategies to use and where to train their faculty members with the Nicaraguan universities themselves. This is paramount for a number of reasons. First is the evidence that when people set their own priorities and design appropriate solutions to their problems, they tend to have a high sense of ownership and are more supportive of the development process. Second, instilling problem-solving and innovative capacities including skills for networking and mobilising resources in order to meet self-set objectives enhance responsiveness to new problems and sustainability. Finally, local universities with enhanced capability to decide what is best for them are vital to democratisation as they, by being an educational setting, will be able to transmit to future generations the importance and value of self-determination and participation in decision-making, at the same time that they become more accountable to collective social forces.

The idea here is for each university create and implement consultation and participation mechanisms so as to produce a “research qualification plan for the future”. This plan should contemplate the needs in terms of faculty training: short term training, disciplines only, research methodology only, full Masters, full Doctors: in which fields, in which universities by which mechanisms.

Finally, I would like to emphasise that it is very important for the universities and for Nicaragua that SAREC support continues. Also, I want to emphasise that the achievements of the collaboration, within the framework in which it was devised, are quite impressive. However, I do believe that if the collaboration is to have the greatest impact on research capacity building that is relevant for development, a number of new directions would have to be implemented. Although I have suggested some here, I think they would have to be decided and devised by the Nicaraguans themselves.

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Ambassador of Sweden to Nicaragua

SIDA officer to Nicaragua

Rector of UNAN-Managua and President of CNU

Rector of UNA

Rector of UNI

Vice Rector of UNAN-León

Executive secretary of CNU

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Juan Martinez

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– CIGEO: presentation by Dionisio Rodriguez

– 2.2. Counterparts in Sweden

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Lars-Anders Hansson

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Visits to the laboratories and short interviews with:

Marvin Corriols - CIGEO Short

Alfredo Mendoza - CIGEO

Francisco Picado Pavón

Katia Montenegro - CIRA

Marta Lacayo

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Nadir Reyes

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Victor Aguilar

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Alberto Sediles

Victor Sandino Dias

Victor Blandón – Executive Secretary of FAITAN

Dennis Salazar – dean of the Faculty of Agronomy

Miguel Rios

Sandra Esquivel Lindo – Directora de docencia

Swedish counterparts

collective interview chaired by Lars Ohlander – co-ordinator

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Collective interview with:

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Edmundo Torres

Rodolfo Pena

Margarita Paniagua

Trinidad Caldera

Susana Quiroz

Swedish Counterparts

Andrej Wientraub- Huddinge University Hospital

Ann-Katrine Palgren – Huddinge University Hospital

Collective interview chaired by Hans Hallander – Smyttskyinstitutet

12.12.1. Commentaries to the report: ANALYSIS OF SAREC SUPPORT TO NICARAGUAN UNIVERSITIES written by Léa Velho

12.12.1.1. Commentary by Dr. Lars Andersson

Links between universities and other sectors of the society such as companies, government etc. are very important (and as far as I know such a link existed in Victor Aguilar's PhD-project). However, equally important is the link between faculty members at Nicaraguan universities and the international scientific society. This link is essential to keep up-dated with relevant research and frequent exchange of

ideas. In contrast to those critical to international publishing I believe that it serves a great need, namely the possibility to get necessary critical comments on the scientific soundness of the work and help to improve methods and clarify conclusions. To continue the build-up of scientific competence it is essential that the international network becomes broader. In the UNA/SLU project PhD-students have been able to take courses at both European and American universities as well as participate in international conferences. This is the first step in the building of an international network. Also, the independence of research is crucial. Thus, when establishing links with national economical and political organisations this must be guaranteed.

The degrees as such are perhaps of low interest but what should be emphasized is the fact that the PhD-EDUCATION provides the scientist with efficient tools necessary to conduct sound research. This includes increased knowledge in experimental methods, statistical analysis and scientific writing.

It is argued that PhD research is not the most efficient manner to stimulate team work as many Nicaraguan PhD-students have to perform their at the university without the support from a professor with an established research group. This, however, seems to me to be the most obvious argument for the need of MORE people with PhD-degrees, not fewer. A quick build-up of such research groups at the universities should be the best way to establish high quality research with efficient team work. This would enable students to perform their PhD-education at a Nicaraguan university and eventually make unnecessary this kind of support (which, of course, is a main aim).

It is said in the analysis that the collaboration is asymmetrical as one part is a student and the other part is a supervisor. This is, of course, true as it always is in a student/supervisor relation and couldn't be otherwise unless we consider a finished PhD-education and scientific experience to be of no value. Mutual respect is essential in this relation but also a great deal of honesty. If collegiality means not criticizing the work of colleagues and students I believe it constitutes a large threat to sound research.

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12.12.1.2. Commentary by Dr. Bo Mattiasson

I have with great interest read the report concerning the SAREC support to Nicaragua. As a former member of the research council and as a Swedish counterpart to one of the projects at UNAN I feel forced to comment on some of the statements in the report.

To start I think it is worthwhile to ask the question "what role will a university have in a country?" A common view is that it shall be the site where knowledge is created and taught to students, thereby multiplying the knowledge. A university is in a sense a sustainable organisation since it feeds itself with new material and information so that it renews itself and develops. The cooperation with the society can take many different shapes, the most important being to produce educated persons. Universities are only to a minor part directly involved in development of processes and inventions that form a basis for future industrial activities. However, the university often creates the basis for such creative work since it fosters students to think independently and to question matters critically. (these are well known facts for many universities in Western Europe).

With this definition of what a university should represent, it is kind of an amazing document that Lea Veho has produced. It is of course welcome to have a debate about the goals and also the means to

reach there, but one needs to break the ideas and viewpoints against each other. In doing so it should also be realized that a university is diverse and it represents many different activities that not necessarily can be lumped together and discussed as one block issue. This is what has been done with regard to the PhD and Masters training where Lea Velho states that it might be more efficient to just take a few courses and not to fulfil a whole education. Such a statement must be reflected in the aims that the person has ascribed to a university. If the goal is to solve urgent needs and to invent various issues, it may be sufficient to give people some relevant courses and then let them work in their normal environment. This is what could be done from a university where some trained persons are located. The argument that persons without a formal academic carrier can also do research is true, but the probability that the research will be carried out in a scientific way with the proper controls etc. is much higher with a PhD-training as basis. Thus, a PhD-training program is usually not aiming at solving an urgent need for a country, but rather to teach a student how to approach a problem in a scientific mode. By doing so with an urgent need as topic of the thesis, one may gain positive effects besides the thesis. The trained person can later on join forces with local entrepreneurs etc. to approach the issue in an holistic, scientifically sound mode.

Lea Velho seems to lump together social sciences and natural sciences and technology into one big issue. This approach might be worthwhile to analyse before taking for granted. In many of the modern technological areas, there is a requirement for a multitude of basic sciences, also at a rather high level. Why should a country bother about learning these complicated issues, if one could form local networks and interact with local industries and NGOs? The society needs a competence to evaluate complicated issues, and to do that one needs a coordinated mode of action. Taking an example from biotechnology: shall one carry out gene cloning in order to improve the productivity, or shall one stay to the more traditional means of operation. Such an issue is by far too complex and too important to leave out to some local networks to decide upon. Here is a need for deep competence in understanding the inherent risks and benefits and to evaluate the impact of such issues of not only society but also the ecosystems.

Lea Velho touches upon an issue that I have been arguing about many times – the implementation of the knowledge that is generated within the academic research. To link this competence to the surrounding society is important in order to get a better utilisation of the new knowledge. Often it is better to involve other people than those heavily involved in research and higher education in this process. Students from such training programs could be good ambassadors for such a transfer of knowledge and technology to the society. Thus, there is in my world no contradiction between higher academic training and implementation of science and technology in society. One has to realise that both things are needed, and one can not replace the other. Furthermore, one needs different actors who are responsible for the two parts. What has often been overlooked is however, to put resources into the second step, i.e. the implementation part. On this point I agree with Lea Velhos standpoint that a better coordination between SAREC and Sida could be beneficial since then there will be possibilities to bring the knowledge to the society and get it implemented there.

Thus, I see no reason to agree with the statements that one shall not continue the higher education in the program as run by SAREC. One should perhaps refine the methodology to evaluate the impact of such training. With the idea that universities will be sites where knowledge is gathered and spread to students, it would be more worthwhile to evaluate the impact of the SAREC program on the education, esp. the higher courses and the choice of topics for project works. This is the site where one first finds effects on higher education from modern developments in science within universities in Western Europe. The same approach could be applied here until someone comes up with a better model.

I do not agree with the results that Lea Velho is reaching in her analysis since I think the analysis is too superfluous and too generalising. It would have been better to make a form with questions that all participants were answering and then to present the results as a frequency result, rather than quoting individuals with statements taken out of their context. One point that is commented on that needs more attention is how the students are taken care of when they reach Sweden. Much more can probably be done in many cases, but also here it would have been valuable to have a more objective mode of investigation than that presented.

The document can be used as an argument in the discussion concerning how SAREC is spending its resources. However, its value is limited because of the weaknesses pointed out above.

Prof. Bo Mattiasson

Center for Chemistry and Chemical Engineering

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12.12.1.3. Commentary by Dr. Henrik Eckersten

5.- Recommendations for the future of the collaboration (to be discussed with Nicaraguan Universities):

1.- Facilitate processes for building links among different institutional actors: government, universities, firms, producers associations, NGOs, grassroots organisations. For example, by funding a series of foresight/scenario building workshops by sector, involving the whole range of stakeholders in order to create a common language among stakeholders, build coalition, foster linkages. Remember that this type of exercise is as (and perhaps, more) process as (than) results oriented.

Kommentar: Building links is good. I support this. Workshops sound however, not very strong and not enough substantial and long term perspective.

2.- Change the core of the SAREC support from Master and Doctoral training to foster local research capacity in partnership among local (public and private) institutions (collaborative projects) – use the bulk of the resources to create opportunities for the local researchers to present research proposals in partnerships with productive sector, and with each other. This may well create the needed links between the nodes of a future innovation system.

Kommentar: This is a very vague proposal. The academic part of it is very unclear. What type of researchers should be trained? Which type of exam should they get? What is the background of the local researchers? As it is written (I can hardly believe it is correctly formulated) most resources should be allocated to proposals. I hope indeed that most resources are allocated to research or /and education. The strengthening of partnership seems to be an allocation of resources to different research and development institutes and/or companies. It is mentioned above that SAREC is the main foundation of the Universities. Does this reallocation of resources mean that the Universities will get big problems to exist in future? If so I think, it should be mentioned that this is a probable consequence of the proposal. What will be build instead?

3.– Instead of one marginally funded research council per university, facilitate a process to create a single and substantive Research Fund in the country. A number of interviewees suggested this and added that SAREC could co-ordinate an action in this direction among like-minded donors and, together with local stakeholders, cut a deal with local government to also contribute to the fund.

Kommentar: Seems to be an administrative problem that is solved, rather than a scientific one. A big problem was mentioned in the text that SAREC is the main foundation. It seems important to have a strategy for how to get more

financial support. For instance, by local interest. The main issue to solve would be on how to make the research attractive to financial sources. Good research maybe is something of interest? Applied research? The time schedule seems here very important. In short term applied research is very important. In long term a research based on science is very important. Science has its roles. I have the impression that the current suggestion, in central parts, question those roles. It is stated that it is not better science because somebody has a PhD. I can agree on that. For me science is related to theories and observations principally independent of the Academic degree of the person formulating the theories or making the observations. But I do not think that is the problem here. The problem is a model that on average give high level of research. The academic model is the one widely used and tested. How does the alternative model looks like, and has it been tested? As concerns the model giving relevant research, the problem is more difficult and I feel that it is correct to highlight this as being a problem. But why ruin the base of research? The base is not the problem. In the long term all research will suffer.

4.– Leave the decisions of what strategies to use and where to train their faculty members with the Nicaraguan universities themselves. This is paramount for a number of reasons. First is the evidence that when people set their own priorities and design appropriate solutions to their problems, they tend to have a high sense of ownership and are more supportive of the development process. Second, instilling problem-solving and innovative capacities including skills for networking and mobilising resources in order to meet self- set objectives enhance responsiveness to new problems and sustainability. Finally, local universities with enhanced capability to decide what is best for them are vital to democratisation as they, by being an educational setting, will be able to transmit to future generations the importance and value of self-determination and participation in decision-making, at the same time that they become more accountable to collective social forces.

Kommentar: The suggestion is OK in large parts. However, not to 100%. How can the student know the scientific roles and the consequences of them before learning them? I think a student has to be trained in scientific research before making scientific research. The risk is obvious that the student finds the scientific method not time efficient and try to find a more efficient method. However, I find the suggestion important for developing more relevant research. But if there is no basic knowledge in scientific research, only the very best self-learning students will be able to make scientific research.

The idea here is for each university create and implement consultation and participation mechanisms so as to produce a “ research qualification plan for the future”. This plan should contemplate the needs in terms of faculty training: short term training, disciplines only, research methodology only, full Masters, full Doctors: in which fields, in which universities by which mechanisms.

Finally, I would like to emphasise that it is very important for the universities and for Nicaragua that SAREC support continues. Also, I want to emphasise that the achievements of the collaboration, within the framework in which it was devised, are quite impressive. However, I do believe that if the collaboration is to have the greatest impact on research capacity building that is relevant for development, a number of new directions would have to be implemented. Although I have suggested some here, I think they would have to be decided and devised by the Nicaraguans themselves.

Dr. Henrik Eckersten

Associate Professor at the Department of Ecology

and Crop Production Science, SLU, Supervisor for Francisco Salmeron

12.12.1.4. Commentary by Dr. Jari Valkonen

The great weakness of the proposed critique directed to Sida/SAREC’s sandwich-type education and development model is that the report tends to make every effort in finding disadvantages, shortcomings and weaknesses at every point of the program, however, not offering anything concrete that could be a realistic alternative. Apparently, the approach taken by Sida/SAREC has been thoroughly thought, takes the local conditions in Nicaragua to consideration, and adapts the approach accordingly. In fact,

the proposed critique with its inconsistencies provides a good proof for it.

All in all, the report includes an elaborate introduction about “development discourse”, which ends up with denying itself. It namely concludes that innovations occur at the interface of research and economic activity. However, both are weak or not developed in Nicaragua and must be strengthened. There is, thus, no chance for a fruitful “interface” until the universities and research institutes are occupied with competent scientist who will be able to provide one side of the interface. How to develop the economic structure is not dealt with in the report, but if it will not be developed, there is little realism in proposing the “interface model” as an alternative to the currently operated model.

The report proposes the Korean case as a paragon: one should not invest in research but in technology transfer. The case is very superficially dealt with and no data are provided to support the claims; the reasons would have been very relevant to discuss, if the case was to be used as the argument to disqualify the Sida/SAREC program. Who are those individuals who have made the success in Korea? Also, the Korean case raises many questions. How many countries will be welcomed to obtain novel data free from other countries that have invested their resources in science and technology? How long could such a “parasitism” be sustainable in absence of skills and resources to produce own novel innovations. Why to use resources to develop applications that, apparently, have been developed elsewhere? Why not just to buy the needed innovations and solutions from elsewhere where better know-how exists?

It surprises that the report puts no weight on the intrinsic value of the capacity to formulate problems to researchable questions and to select the right, critical and best methods to answer the questions. The competence of handling problems in this systematic and critical manner is obtained during academic education, and the academic degrees indicate the level of maturity and competence, as well as the competence area. Providing Nicaraguan scientist with the aforementioned competence indicated with an academic title makes them equal and correctly understood partners in an international network for transfer of knowledge and technology.

One of the least consistently discussed topics of the report concerns the claimed disadvantages of the sandwich model:

...It is part-time: it is not as part-time as claimed. Students carry out thesis research also at their home institute (at least in UNA-SLU PhD program). The continuing interactions with students and colleagues via teaching and meetings enhance transfer of the new knowledge, which otherwise would “accumulate” until the end of the research/study visit to another laboratory has been completed. Also, the sandwich arrangement allows introducing changes in the infrastructure and institutional working models little by little. It is well-known that people who have been elsewhere and return home requesting everything to be changed for the better are met by persistent resistance and are silenced. After some attempts to fight back, these persons get frustrated and leave, often to abroad.

...Adaptation: there is nothing wrong to develop skills for adaptation to different working environments. Such flexibility is necessary for all creative, scientific work. Approaches, methods and solutions need to develop and change by time, and the best guarantee for the development is that the actors involved are not afraid of changes but can be the leaders for them.

...Being away from family: there is no solution to this problem in any of the putative alternative models (which are in fact not described), unless donors provide funding for the whole family to move.

...Difficulties in being part of a team in Sweden: Our experiences do not support this claim at all. Furthermore, dispatching the person from home institute for studies abroad for a longer period than half a year is risky, not to speak about being years away. The place of the person in the system will be

filled with someone else if the absence will take longer. How should the home institute otherwise cope with the situation that a teacher or a project leader disappears for a long period of time? They will find someone else to take care of the job. What shall the trainee do when she/he returns from the leave of absence?

It is claimed in several parts of the report that Swedish supervisors are uninterested in the program. At the same time it is proposed that the Nicaraguan scientists should have the opportunity to choose other countries for training and stay longer periods abroad. It would be worthwhile to analyse why the Nicaraguan scientists are expected to be more welcomed to institutions outside Sweden? Furthermore, the report proposes that visits to abroad could be partially replaced by visiting foreign professors working at the Nicaraguan institutions. Again, referring to the claimed lack of interest of the Swedish scientist to visit Nicaragua, how could the interest be increased, or from where are the visiting professors expected to come from?

It is to a high degree agreeable that linkages and partnerships within Nicaragua should be enhanced. The report, however, claims that such activities would increase “local research capacity”. It does not have such an effect unless the competence of researchers and the capacities of institutions are increased by education and infrastructure development, *i.e.*, the activities of the current Sida/SAREC program. The report uses the term “research” in all contexts referring to “problem-solving”, including cases not necessarily including any apparent researchable component needed for achieving a solution. The confused use of the terms may reflect that it remains to be crystallised which means are needed for what purpose. This appears to be a weakness of the critique proposed in the report.

The ideology of giving the funds to the target country without strings and ties, providing the full freedom to use them as appropriate, sounds familiar. I believe that such a model has been used in the past. It might be useful to analyse why the current model was adopted to use, however.

The Sida/SAREC program has been designed to result in Nicaraguan scientists with modern academic education. What I have learned in the UNA-SLU PhD program is that UNA has always been the partner proposing which persons and which study areas should be included. Apparently, all choices and strategic decisions have remained at UNA. A similar mechanism has been used in the Sida/SAREC-funded BIO-EARN program concerning a similar sandwich arrangement for education between Sweden and East African institutions. The ownership of the program is strongly with the non-Swedish partners. It is therefore difficult to agree with the claims of lack of opportunity to affect decisions.

The overall impression on the report suggests a pre-determined need for suggesting a change in the program, but the arguments proposed to justify the changes are weak and contradictory.

Dr. Jari Valkonen

Associate Professor at the Department of Ecology
and Crop Production Science, SLU

12.13. Commentaries to the: UNI Evaluation Report written by Thomas Alveteg

12.13.1. Comentries from UNI academics

We have several observations to the evaluation report: *“Evaluation of the Future Direction of Research Cooperation between Nicaragua and Sweden: Annex 3, Universidad nacional de Ingeniería (UNI), Managua”, prepared by Thomas Alveteg, October 2002.*

Our objections concern the evaluation of the co-operation between the Faculty of Chemical Engineering at UNI and the department of Chemical Engineering at KTH. The objections can be summarised as follows:

- Some of the information is not correct: dates, facts, etc.
- We do not agree with some criticisms.
- The analysis is not impartial.

As a consequence, we do not agree with most of the recommendations of the evaluator. We will refer to these three main topics sequentially and then we will refer to the recommendations.

A. Incorrect information

Wrong dates:

There are several dates that are not correct. We rectify the information in a short historical description of the co-operation:

- The date in which the co-operation between UNI and KTH in Chemical Engineering was initiated was 1986.
- In 1985, people from the Chemical Engineering Dept., Electrical Engineering Dept., and Co-operation Unit at KTH together with people from Sarec visited UNI to discuss co-operation. Among others, the departments Chemical Engineering (FIQ) and Electrical Engineering (FEC) were visited. To define the date of that visit, as the start of the co-operation would lead to the wrong conclusion that even co-operation with FEC started at that date.
- The co-operation between UNI and KTH was initiated in 1986 with three students who had not obtained their diploma yet. The areas were Drying and Crystallisation and involved only FIQ. At this stage, the people from Electrical Engineering at KTH were not interested to co-operate with UNI.
- The proper research co-operation with FIQ (involving engineers and PhD studies) started in 1987 and was extended to the area of Process Engineering in 1989 with one undergraduate student.
- The three students from the Drying area obtained their Technical Licentiate degree in 1992 and 1993. The two students from the Crystallisation area obtained the Technical Licentiate degree in 1995 and 1996.
- The elections of new authorities at (FIQ) were in 1994. The elected authorities were in function until 1998. During this period, all the teachers that had obtained the technical licentiate degree within the programme left the university because of the policy of the new authorities.
- The area of Crystallisation was closed in 1997 and two researchers initiated their studies in Waste and Drinking Water Treatment in 2001.
- At the present, there are ten students involved in the programme including the two entering in autumn 2001 in Environmental Engineering. No participants from the beginning of the co-operation remain in the programme today.

Errors in the table of participants

Here, there are printing errors concerning names, degrees, and dates. It is evident that it would not be possible for part time students to complete PhD degrees, as they were full time students. We provide a new table 2 with the corrections. We also update some information that has changed since the evaluator collected the information.

Table 2: *Student currently involved in the Sida/Sarec research-training programme in Chemical Engineering:*

Student	Degree	Starting year	Expected year of completion	University, supervisor
Rodolfo Espinosa /Process Engineering	PhD	1989	2003	KTH, Dept of Chemical Engineering, Joaquín Martínez
Javier Ramirez / Process Engineering	TkL	1996	2003	KTH, Joaquín Martínez
Martha Benavente /Process Engineering	MSc	1999	2003	University of Chile, Jesús Casas and Joaquín Martínez
Claudia Martinez /Process Engineering	MSc	1996	2003	University of Chile, Jesús Casas and Joaquín Martínez
Marcia Vargas / Drying	TkL	1994	2003	KTH, Joaquín Martínez
Leandro Páramo / Drying	TkL	1999	2004	KTH, Joaquín Martínez
Rafael Gamero / Drying	PhD	1998	2005	KTH, Joaquín Martínez
Francisco Vilchez / Drying	TkL	2001	2004	KTH, Joaquín Martínez
Indiana García /Waste Water Treatment	PhD	2001		KTH, Dept of Chemical Engineering, Luis Moreno
Larisa Korsak / Waste Water Treatment	PhD	2001		KTH, Dept of Chemical Engineering, Luis Moreno

Errors in the list of publications

The following should be the table of publications (not just submitted, but published) with the information that was available by the time the evaluator collected the information:

Table 4: *Chemical Engineering Programme, submitted and/or published papers and posters from 1993 and onwards* *).

Research area	National	International published	Total
Crystallization	2	7	9
Drying	4	11	15
Process Engineering	4	9	13
Total	10	27	37

*) No publications before 1993, or after 2000 were reported to the evaluation team

During 2002 (after the evaluator collected the information) 4 works, 2 in Drying and 2 in Process Engineering, have been presented in international conferences.

Concerning publications there is a statement in the evaluation that is not sustained by any argument, namely: “Of the earlier works published in international journals, the majority refers to the now closed component in Crystallisation”. The fact is that until 1997 (the last year that the researcher initially in the programme contributed to publications) Drying had 12, Crystallisation had 9, and Process Engineering had 6 publications, respectively. The statement is clearly inconsistent, particularly if we consider that two of the members of the drying group had already left the university in 1994 and the third in 1995.

B. The criticisms

Some of the criticisms mentioned by the evaluator are: the poor conditions of laboratories, poor planning of the individual research projects, and relations to the Swedish counterpart.

The poor conditions of the laboratories

The statement that the poor conditions of the research laboratory facilities are due to the lack of a strategy for development and maintenance is not correct. The evaluator should know that to implement such a strategy is not possible without proper infrastructure and institutional support. The evaluator was well aware about the lack of real institutional support to the research but has preferred not to mention it. On the contrary, he presented a very positive evaluation of the efforts of the authorities to improve education, research, and the university administration. It is true that a modernisation of UNI has taken place mainly concerning buildings but few steps have been directed to support the research programmes. No a single laboratory has been built for years. In spite of promises, small needs of infrastructure that could be solved with a fraction of the resources used in administrative buildings have remained unsolved. Even the reparation of air conditioners has been denied with the motivation that the projects have own funds to pay for that, in evident violation to the compromise acquired by the University to provide infrastructure to the projects, when they accepted Sarec support. Of course, it has not always been so and the situation has been improved since a new director, Leonel Plazaola took possession of the direction of research during 2001. The Faculty of Chemical Engineering has strategic plans for the development and maintenance of the laboratories and has tried in vain to obtain more space during the last years to implement it.

Poor planning of the individual research projects

It is difficult to know if the evaluator means with poor planning the planning itself or a bad assessment of the conditions to fulfil the plans. Concerning planning, every PhD students at KTH, must have every year a detailed study plan. According to our experience what is difficult is to predict the conditions to fulfil the plans, particularly in the changing conditions existing in UNI.

Courses at KTH are mentioned in several places in the evaluation as an obstacle for planning. It is difficult to know if the opinion about courses at KTH is a general opinion among Nicaraguan researchers or not. The fact is that the perception exists. However, the evaluator should conciliate this perception with measurable facts to assess if the topic deserves the importance that it receives in the evaluation. It is a fact that the availability of PhD courses is limited at KTH but there is no a single case at FIQ where courses had delayed the achievement of Tek. Lic. or PhD degree. On the contrary, most of the credits have been achieved under short time in the first years, sometimes several years before the thesis work has been completed. The fact that courses are cancelled just a week or a few days in advance happens very seldom at KTH (we do not know any case). In addition, it has been a practice in the FIQ-KTH co-operation to take into account under evaluation courses not performed in KTH or Sweden and include the corresponding credits among the credits required for the Tek. Lic. and PhD degrees.

It must be emphasised that the critical step for the scientific output of the projects is the thesis work, not the courses. A better co-ordination of courses (both in KTH and by overcoming the inflexible rules at UNI) is always good but it will not improve the scientific production. The feeling that the time in Sweden would be devoted only to courses is also a wrong conception considering the difficulties that they have had to perform research in Nicaragua.

Of course, planning can always be improved but the crucial step is to create the conditions to fulfil the plans and mainly during the research work in Nicaragua. Teaching duties are certainly a problem. To solve it, UNI should determine more precisely the teaching time that different courses demand before distributing teaching duties. Today, the authorities talk about groups, independent on the content of the course and the number of students. In addition, the decisions about the academic charge are taken at Vice-Rector level with very little insight in the real needs of the faculty. To improve the status of the research work would be of great importance. In general, the understanding of the conditions of the research is bad in UNI and sometimes the attitude against research is hostile. The situation of the researchers has not been improved for years in spite of funds obtained with that purpose and repeated promises in that sense. However, some promising changes have occurred the last year and the first step to provide economical support to researchers has been undertaken.

Relations to Swedish counterpart

Associated Prof. Joaquín Martínez has the supervision of eight of the ten students included in the programme. There are two of eight students who have, in addition, Chilean supervisors during at least half of the year per year. This is not an unusual number of PhD students for a supervisor at KTH. What is unusual is that all the PhD students are working according to the “sandwich” model that is good for the development of UNI but less good for the individuals (including the supervisor) since the scientific production is less effective. However, this can be hardly considered a disadvantage in matter of co-operation.

Several statements in the evaluation give the feeling that there is a monopolising action to prevent the contact between Nicaraguan researchers with other researchers. The criticism is difficult to understand if one considers that the contact with Chile was an initiative of the Swedish supervisor. In addition, Professor Fredrik Setterwall was the project co-ordinator until year 2000 and Professor Åke Rasmuson had the supervision of the Crystallisation area until 1997 (most of the time with two of five and two of six of the research students).

Among research students, we have had, all the spectrum of personalities, from people who never liked to be in Sweden and never participate even in coffee breaks to people who liked so much Sweden that became married and stayed in the country. As Swedish postgraduate students, Nicaraguan researchers are invited to all activities within the department (academic and informal). Of course, people can be encouraged to participate in institutional activities but not compelled to do this. In this respect, Nicaraguan researchers have not been worse or better than Swedish postgraduate students have.

The evaluator says that it might be better for the general development of the research capacity at the Faculty of Chemical Engineering at UNI if the group of supervisors were widened. Such statement seems not to be supported by real facts. The research programme at FIQ is not less effective or more expensive per PhD student than other programmes at UNI that would fulfil much better the criterion of a wide group of supervisors.

We think that if one is interested in opening new research areas in the co-operation with Nicaragua they can be justified by themselves and it is not necessary to point out problems that are not really problems to widen the group of supervisors.

That the evaluator considers now very positive that associated professor Luis Moreno will supervise the two students in the new project in wastewater treatment is anyway a step forward. He did not have the same opinion when he tried actively to convince the students to change supervisor during the interviews in the period that he was collecting information.

C. The analysis is not impartial

To include all historical details of the projects in the evaluation is maybe not possible but the evaluator should devote the same level of details in the description of all the programmes. The evaluation is plenty of small details where other programmes are enhanced and the FIQ Programme is lowered explicitly or by omission. As an example, the evaluator does not specify quantitatively (as he did in other areas) the contribution of the FIQ areas to Nicaraguans undergraduate theses and Swedish Master theses supervision. Researchers of the FIQ Programme have supervised 50 undergraduate theses within drying, crystallisation and process engineering subjects (both purely research-aimed and industry-related) from the beginning of the agreement, as well as 16 theses of Swedish master students (two of them will be defended at the most in April 2003). These theses include a total of 27 Swedish students supervised by our researchers.

As another example, we can mention the criticism of FIQ's publications mentioned before while the high level of publication in other programmes was eulogised. For the sake of objectivity it would have been convenient to mention that the only publications in top international magazines have been produced in Drying. In addition, one of them is cited in the most used text for education in Chemical Engineering (***Chemical Engineering*** by Coulson & Richardson, vol. 2, 5th ed., Butterworth Heinemann, UK).

It is quite evident that the few positive mentioned in the evaluation is used to justify phasing out the chemical engineering programme and moves projects to CIEMA, a centre that is evidently of the evaluator preference. We will refer to that in connection to the recommendations of the evaluator.

About the recommendations

Step-wise phasing out of the Chemical Engineering Programme

The main reason behind this recommendation is the conclusion of the evaluator that the Faculty of Chemical Engineering is strong enough to perform research without the present support from Sarec. As mentioned in connection to the errors of the table of participants the number of PhD, MSc and Tek. Lic after the period 2001-2003 could never be as large as stated in the evaluation. The statement that 50% of the teaching staff of the faculty is involved in Sarec projects is too high, 20% is a better figure. On the other hand, 50% (probably higher) is the support of the staff involved in Sarec project to the activities of the faculty (teaching, etc.). Certainly this is not an advantage to perform research.

These discrepancies added to the lack of emphasis to clarify that all the researchers who achieved the Tek. Lic in the first phase of the programme left the University between 1994 and 1996 lead to the erroneous impression that the development of the research group at FIQ is stronger than it really is.

In matter of sustainability we envisioned, already in connection to the application for the period 1998-2001, the necessity of creating conditions of sustainability to phase down the support. The conditions we defined were: i) the existence of a stable group of qualified researchers, ii) a strength contact with the industry through consultancy work and, iii) to have a working local Master Programme in Chemical Engineering. With these purposes, we applied for funds:

- To support researchers in Nicaragua in order to counteract the negative effects of the agreement 140 on research activities. (According to this agreement teachers need to work only part time to get full salary at UNI to allow them to improve salaries with other activities outside university)
- To start joint project with the industry to improve the confidence for the work performed at the University from the industry side.
- To start the Master Programme to reproduce research activities and improve education.

We got the funds for researchers support, and co-operation with industry. Unfortunately these funds were moved from the faculties to rector level with following results: incentives for researchers were not introduced until 2002 and the funds for supporting industry projects have been used to support diploma works and to provide with technical means of assistance a couple of rooms. We got some support to develop a Master Programme from year 2001.

It is clear that under such conditions, the progress was slower than planned and the sustainability goals were not fulfilled. However, we expect that by the end of the present period, we will have a more or less stable group of researchers, we will be prepared to initiate the Master Programme and some advances in industry contacts. Since the conditions of sustainability are not completely fulfilled, we do not agree to phase down the support in the way recommended by the evaluator. For instance, it would be a waste of resources if we do not allow those who completed the MSc or Tek. Lic. to complete the PhD degree if they are interested. (not all of them have plans to do that). The rigid recommendation of stopping researchers in these conditions seems to be unnecessary and a waste of resources, particularly if we consider that the conditions of stability at UNI are very volatile and a group can be reduced unexpectedly.

The newly started support in environmental engineering

No argument to recommend that the project in waste and drinking water treatment should be transferred to CIEMA is presented in the evaluation. This recommendation should be astonishing for those who know the history and the present situation of CIEMA. Even if there is not our intention to mention other programmes than the chemical engineering programme, the recommendations of the evaluator compel us to introduce a brief reference to CIEMA.

International support to Environmental Engineering in UNI is not new. It started with Dutch support to programme called INGAM in 1985. The programme was renamed later to PIDMA. In 1993, the Dutch conditioned the continuation of the support by demanding that the programme should joint to the Faculty of Chemical Engineering, which was a well organised and a well functioning faculty. This was done formally and administratively but, in fact, PIDMA kept on working independently. In this period, teachers from Chemical Engineering and Civil Engineering performed Master studies within the Programme in Netherlands with the purpose of being incorporated as teachers to the Master Programme conducted in PIDMA. This never worked because of the closed organisation of PIDMA. Finally, Netherlands withdrew the support year 2000. After the withdrawal of Dutch support to PIDMA, the authorities of UNI made efforts to build a centre of Environmental Engineering, CIEMA that would include different programmes working with environmental and energy issues at UNI to obtain new support. Today, after a couple of year trying to organise the centre the only which remains in CIEMA is PIDMA the old programme from which Netherlands withdrew its support. All other groups with activities in environmental Engineering left the centre because of the difficulties to co-operate with PIDMA.

The evaluator should know this situation because he had in the past, during several years, co-operation with the same person who is now in charge of the aborted CIEMA.

Strategy for the research laboratories

Plans for use of the laboratories in research and in the Master Programme have been established at FIQ. As mentioned before, the relative state of disorder and deficiency steam mainly from the lack of support with infrastructure from UNI authorities. This support has not been given in spite of the low costs demanded (compared to other investments currently going on at UNI) and repeated promises. Therefore, the eulogies received by the authorities of UNI in the evaluation are very

surprising. The situation was improved recently under the new research director, but it is not a good reason for the omission due to the great influence of the institutional support on the research projects and that the conditions may change very rapidly at UNI.

Relation to the Swedish counterpart research environment

This topic has been already commented under the criticisms. It must be added that it is difficult to consider seriously the positive view that the evaluator has now about the supervision of associated professor Luis Moreno in the new project in wastewater treatment since he tried to convince the students to change supervisor and co-operation departments during the interviews.

Competing research areas/projects within the Sarec support

The evaluator seems to claim that other research projects conducted at the Faculty of Chemical Engineering that can be of potential interest for CIEMA (e.g.: lixiviates from mining waste disposal sites) should be also transferred to CIEMA. Apart, from the fact that CIEMA does not exist as real centre we have two fundamental objections to this recommendation. Firstly, being environmental research multidisciplinary there will be always research projects of potential interest to other groups who claim activities in Environmental Engineering. We do not think that it is a reason to seize on projects developed by others. For instance, the fact that most of separation methods of Chemical Engineering are used in environmental cleaning and remediation is not a good reason to state that chemical engineers own all the projects that use such methods. Secondly, the procedure is not a good signal for CIEMA, if we want to encourage them to prepare good applications to obtain their own projects. In fact, the applications in the field of Environmental Engineering mentioned above were open for all departments at UNI who claim activities in environmental Engineering and Sarec did not select the projects of PIDMA because of the poor quality of the applications. This situation will not be improved with the recommendations of the evaluator.

Summary

We think that even though the evaluation point out many of the main problems that affect the development of the research programmes at UNI, it also reveals a poor knowledge of the real situation in some areas of the University. In addition, some of the recommendation steams rather from the preferences of the evaluator for Environmental Engineering (he is filed of interest) than a careful analysis of what would be better for the development of research capability in the faculty of chemical engineering and in UNI.

We think that to follow the recommendations concerning the Chemical Engineering Programme would be equivalent to destroy the research capability developed in the Faculty that in spite of the difficulties has contributed to the development of UNI.

Rafael Gamero, FIQ Programme Co-ordinator

Silvio Rojas, Dean of the Faculty of Chemical Engineering at UNI

Joaquin Martinez, Swedish Co-ordinator and KTH Supervisor

12.13.2. Response of Thomas Alveteg to above commentaries

Dear Ing Gamero, Ing Rojas, and Dr Martinez:

I have received your comments on the draft evaluation report of the Sarec supported cooperation with UNI. I do appreciate your thorough reading and has tried to amend my report where you found that dates in the historical description of the cooperation were not correct. In your letter you expresses

“objections” to the evaluation report. Most of these unfortunately refer to topics where we obviously have different opinions, or have come to different conclusions, and they will therefore not change my point of view as stated in the report. Nevertheless, as some of the issues raised are more than just ordinary comments on the content of the report itself, I thought better to comment some of them in the following:

A. Incorrect information

Date of initiation of cooperation: I have changed from 1985 to 1986 as you pointed out. Reason why I used 1985 was that the cooperation agreement was signed May 10, 1985, - and then project research activities started in January 1986.

I have corrected the dates of the completion of the first five TkL degrees (1992,1993,1995,1996), and also the period for election of authorities at FIQ (1994-98)

Regarding the “printing errors concerning names, degrees and dates” in table 2 of my report:

The information is derived from the “table 2” in the document that was provided to the evaluation team by Ing Gamero and Plazaola¹. I presume that the information given to the evaluation team was correct when presented in June 2001. In the updated information provided by Gamero, Rojas and Martinez, the date of the completion of the degrees for several of the individual students has been postponed or delayed one to three years, and further a new student has entered the programme, Ing Francisco Vilchez. However another student, Sergio Luis Garcia, is excluded from your updated information – which I presume means that he has left the programme?

I am aware of the fact that a long time has passed between the first interviews and the publication of the evaluation report and that naturally implies that some information are not fully up to date, and I do regret any inconvenience that this might have caused.. Nevertheless, in order to keep consistency with the time and information available when the evaluation was carried out, I have decided not to change the table in the evaluation report. On the other hand, the fact that the dates for completion of the degrees has been postponed, rather support the opinion expressed in the evaluation report regarding deficiencies in planning of each project.

Errors in table 4: publications...:

My information was derived from Appendix 5 “Publicaciones y contribuciones en congresos programa FIQ”, to the previous mentioned document². In this appendix only a total of 32 publications are listed, 5 of them non-scientific or internal UNI publications which I did not include in my table (which of course can be argued). Then Ing Gamero was kind enough to provide me with copies of 26 publications (international, national and internal); from the list (15), and additionally 10 publications that were not on the list, of these 2 to was written in 1998-99 by Luna and Martinez outside the Sarec programme. Nevertheless I presume that your counting is the correct one, (even though I have not seen a complete list of publications), and has therefore changed table 4 in the report. However, if you have a complete list of all the 37 publications I would appreciate if you could send it. In consequence I have also omitted the sentence regarding that “..the majority refers to the now closed component in Crystallisation”

B. The Poor conditions of the laboratories

In your comments there are references to the lack of attention to this issue by the UNI administration. The recommendation “to formulate a strategy for development of the research laboratories on short- and long-term basis”, refers of course not only to the Faculty but also to the UNI administration.

¹ “Documento Síntesis de la Cooperación en Investigación UNI-ASDI/SAREC”, Junio 2001

² “Documento Síntesis de la Cooperación en Investigación UNI-ASDI/SAREC”, Junio 2001

C. Poor planning of the individual research projects

“Poor planning” refers to both the actual planning itself and obviously the assessment of the conditions to fulfil the plans.

During the evaluation, it was unfortunately not possible to retrieve any “hard” measurable data on the problems with planning of courses at KTH for the students. Nevertheless almost every student interviewed at UNI, brought this up as an important constraint.

D. Relations to the Swedish counterpart

The evaluation report to my opinion, give good credit to the work by the Swedish supervisors, particularly Dr Martinez. However, that does not exclude the fact that the cooperation would benefit if the group of supervisors were widened.

Then to the rather odd accusation that the evaluator: “..tried actively to convince the students to change supervisor during the interviews in the period he was collecting the information”. - If students during the interviews expresses that they were not happy with the topic selected for their research project nor with the supervisor, I guess it is quite a natural question to ask why they do not bring this up to discussion with the programme coordinator and Swedish counterparts – to find another more suitable supervisor, rather than continue research training in an area that do not interest them. It is my belief that considering the long period of cooperation, the Faculty of Chemical Engineering, should work towards a more symmetric relationship in the cooperation with the Swedish counterpart.

E. The analysis is not impartial

You are of course free to have the opinion that I have not been impartial in my assessment, though from my point of view I do not find that this opinion can be derived easily from the evaluation report. If not only the fact that I recommended a step-wise phasing out of the chemical programme is an impartiality per se.

Regarding the FIQ’s publications, the intention was not to criticise what has been published, but rather drawing the attention to that the number of publications are relatively few over the last years.

F. Step-wise phasing out of the Chemical Engineering Programme

Referring to the 50% mentioned in the evaluation report: (“The “Sarec group” is large within the Faculty, about 50% of the teaching staff involved in different levels of the Sarec programme”). This was the figure mentioned in the interviews, which I considered a good indication of the programme achievements. This has now been adjusted to 20% according to your comments.

G. “The newly started support in environment engineering” and the following subchapters to “the Summary”

The proposal from UNI to Sarec regarding support to the new CIEMA, was reviewed in a separate feasibility study, and I therefore refer to the conclusions and recommendations to UNI that I made in that specific report¹.

At the end of the summary chapter of your comments you express that “..some recommendations stems rather from the preferences of the evaluator for environment engineering (his field of interest) than a careful analysis..” This is of course a rather grave accusation, and none the less ridiculous. I do not see how this kind of accusations will improve the evaluation process and will therefore not attempt

¹ Alveteg, T., November, 2001. *“Feasibility Study, of the Potential for Support to Capacity Building in Environmental Sciences at the National University of Engineering (UNI), Nicaragua”*. Akkadia Environment Management Consultants, Stockholm, Sweden.

to continue any further argumentation on this subject. Nevertheless I do recommend reading the CIEMA feasibility study, particularly as the two priority areas for proposed research are also research areas at the Dept of Chemical Engineering at KTH, and one of them the waste water is obviously a new priority for the Faculty of Chemical Engineering at UNI.

I think that we all agree that research capacity building takes time, particularly in the light of the historical context of the development of the universities in Nicaragua, which I very briefly referred to in the introduction. Still, after 17 years of cooperation I believe that the chemical engineering programme has reached a substantial level and it is therefore time to think about a step-wise phasing out of the Sarec support over the next few years (which is not the same as an immediate closure). Nevertheless, in spite of the disagreement with the recommendations for the Chemical Engineering Programme stated in the evaluation report, I do hope that you will find the report useful in the further discussion with Sida-Sarec on the future of the cooperation

Best regards,
Thomas Alveteg

12.14. Questionnaires

12.14.1 General questionnaire

Program:

Project responsible:

Year the project initiated:

N° of publications generated during the collaboration: National ____, International ____

Participants:

With the following degree	Total N° of participants	Trained with bilateral funds
Ph.D.		
MSc.		
Diploma		
Other		

Performing studies abroad:

Level	Total N° of participants	Trained with bilateral funds
Ph.D.		
MSc.		
Specialization		

Mention the main achievements

Mention the main problems

How do you envision the future of the bilateral collaboration? Be specific.

12.14.2. Specific questionnaire.

The content of this questionnaire is absolutely confidential

Project name:		
Sex:	Date of birth :	
Higher University degree:	Where did you obtained:	
Do you study:	Place:	Academic level:
	Began in:	Finish in:
Present University position:		
Marital status:	Number of children:	

Table 1. If you have carried out studies in abroad please answer the questions.

a) Did you require English language during your training?	None.	Moderately.	A lot	No response
b) Did you have English language problems during you studies?	Many	Moderately.	None.	No response
c) Did you like your research project?	Little/none.	Moderately	A lot.	No response.
d) Was your stay abroad useful for you?	Little	Moderately	A lot	No response
e) Do you still work in the same subject of your thesis?	Little/no.	Some times.	Frequently	No response
f) Do you still collaborate with you tutor?	Little/none.	Some times.	Frequently.	No response
g) Did you have academic problems during your training?	A lot	Moderately	Little/none	No response
h) Have you applied what you have learned in response your training?		Little/none.	Moderately.	A lot No
i) Have you taught what you learned in your training?	Little/none.	Moderately.	A lot	No response
j) During your training, the collaboration environment was	Bad	Moderately.	Good.	No response.
k) Was your tutor well versed in his/her specialty?	Little.	Moderately.	Very much	No response.
l) Did you have economical problems during your training?	A lot.	Moderately.	None.	No response.

Table 2. If some questions do not apply to you, live them without mark.

a) Time devoted to teaching	less 25%)	25%-50%	more 50%	No response
b) Time devoted to research	less 25%	25%-50%	more 50%	No response
c) Time devoted to administration	less 25%	25%-50%	more 50%	No response
d) Do you like your work?	Little/none	Moderately	A lot	No response
e) You are hired for	< time	time	> time	No response
f) Is your salary adequate for the work you perform?	Low	Moderate	Adequate	No response
g) Do you have another job?	Yes	Some times	No	No response
h) Do you have help from a technician?	Yes	Some times	Never	No response
i) Do you collaborate with other Departments?	Little	Some times	Regularly	No response
j) Do you collaborate with other Nicaraguan Universities?	Little	Some times	Regularly	No response
k) Do you collaborate with your colleagues?	Little	Some times	Regularly	No response
l) Do you collaborate with foreign institutions?	Little.	Some times.	Regularly	No response
m) Do you have national grants?	< \$100	\$100–\$1000	\$1000	No response
n) Do you have international grants?	< \$ 500	\$500–\$3000	\$ 3000	No response
o) The physical facilities of you working place are	Poor	Regular	Good	No response
p) The laboratory facilities are:	Poor	Regular	Good	No response
q) The teaching facilities are:	Poor	Regular	Good	No response
r) Do you have access to computers?	Little/never	Some times	Always	No response
s) Do you have access to E-mail and Internet?	Little/never	Some times	Always	No response
t) Do you find what are you looking for at the library?	Rarely	Some times	Always	No response
u) Do you work alone?	Always	Some times	Rarely	No response
v) Do you speak English	Poorly.	Moderately	Well	No response
w) The library service is	Poor	Regular	Good	No response
x) The purchasing services at UNAN are	Poor	Regular	Good	No response
y) The management of funds for research is	Poor	Regular.	Good	No response
z) Do you take courses for upgrading your knowledge?	Rarely	Some times	Commonly	No response
aa) Do you assist to symposia or training courses abroad?	Rarely	Some times	Commonly	No response

12. 15. Question for Group Discussions and Workshops

12.15.1 Five questions to be discuss by the groups in June 2001 *

- a.– According to an historical perspective of the bilateral program describe the positive and negative aspects of the collaboration. Please point out the indicators used to evaluate these two aspects.
- b.– What do you understand by scientific potential within the University context? What kind of indicators would you consider relevant for measuring this scientific potential? In which direction this potential has influenced the academic and scientific environment of Nicaragua?
- c.– Once the Scientific potential would reach its maximum, what would you do to make it sustainable in the long term?
- d.– Regarding the bilateral program, do you believe that the responsibilities between the Swedish and the Nicaraguan counterparts are evenly distributed and symmetrical? Please describe the level of ownership you perceive with respect to the bilateral collaboration.
- e.– What do you expect regarding the bilateral collaboration between the Nicaraguan Universities and Sida/SAREC? How do you envision the future with respect to the concentration of the different actors, and which level of responsibility do you perceive in the various supportive elements?

* The purpose behind these questions was not to obtain a precise answer, but rather to promote the discussion on sensitive, difficult and some time evasive and unanswerable questions that seldom are discussed between groups participating in the bilateral collaboration. By this, the evaluators obtained valuable qualitative information to be judge and to compare within the framework of the evaluator's perspectives.

12.15.2. Five themes to be discuss by the reflecting teams February 2002 *

I.– The different roles of the counterparts

- a.– What are the roles of the Swedish and the Nicaraguan counterparts?
- b.– Is it possible to have symmetry in the research cooperation, and if so, on which conditions can be achieved?
- c.– Who takes the decisions at the Nicaraguan Universities and Sweden?
- d.– What are the incentives for the Swedish counterpart to participate in the bilateral cooperation with Nicaragua?
- e.– If triangulation is going to be implemented with third countries, what would be the role of Sida/SAREC?
- f.– What kind of solutions exist for the students already enrolled in the Ph.D. sandwich model.
- g.– What kind of solutions the Nicaraguan Universities envision to resolve the difference in gender in the bilateral collaboration with Sweden?

II.– Sustainability of research activities at the Nicaraguan Universities.

- a.– What kind of measures you would take to make research a permanent and recognized activity at the Nicaraguan Universities ?
- b.– What criteria would you use to evaluate the research activities?

- c.– By which strategies the investigator could have the same level of recognition than the academics and how would the different activities could be judged?
- d.– By which means the different Direction (Vicerrectory) of Research offices could participate more efficiently in promoting research activities at the Nicaraguan Universities?
- e.– Which strategies you envision the make research a sustainable enterprise

III. Research activities in the Nicaraguan Universities at the end of the bilateral program with Sida/SAREC

- a.– When the critical mass of investigators could be reached?
- b.– How long the bilateral program should last and which would be the criteria to conclude the program?
- c.– What would be the motives to close ongoing research projects or the program?

* The purpose behind these questions was not to obtain a precise answer, but rather to promote the discussion on sensitive, difficult and some time evasive and unanswerable questions that seldom are discussed between groups participating in the bilateral collaboration. By this, the evaluators obtained valuable qualitative information to be judge and to compare within the framework of the evaluator's perspectives.

12.16. Recommendations by the public Universities of Nicaragua.

12.16.1. English version

“PRESENT PAST AND FUTURE IN THE RESEARCH COOPERATION BETWEEN NICARAGUA AND SWEDEN” General Workshop, February 22, 2002

Written by Edmundo Torres, UNAN-L; Charles Wallace, UNAN-M, Freddy Alemán, UNA y Leonel Plazaola, UNI. February 2002, Managua, Nicaragua

I. SHORT TERM RECOMMENDATIONS FOR NICARAGUAN UNIVERSITIES

- a. Universities shall establish the norms and rules for research activities promoting by this manner the institutionalization of these activities and securing the relevance, sustainability* and continuity of research.
- b.– Based on the requirements and relevance of social problems**, Universities shall establish permanent processes for the identification of research priorities.
- c.– The four public Universities of Nicaragua (UNAN-L, UNAN-M, UNI and UNA) shall envision a common research system that would allow the organization of interdisciplinary and interinstitutional groups; this eventually would favor the consolidation of groups that could share their strengths and collaborate in the development of common projects.
- d.– The Nicaraguan Universities shall initiate a plan for the information on the achievements and objectives of the current research projects

II. LONG TERM RECOMMENDATIONS FOR NICARAGUAN UNIVERSITIES

- a.– To transform and adjust the organization of the University administrative system to build up and secure the sustainability of the research activities.
- b.– To establish a network of institutions in order to encourage science and technology for national development.

III: SHORT TERM RECOMMENDATIONS FOR SIDA/SAREC

- a.– Sida/SAREC shall support and strengthen the development and organization of University administration in order to establish a system for the reinforcement and sustainability of research activities.
- b.– Sida/SAREC shall support links between the Universities and society. These links should promote the knowledge and the application of the results generated by the investigations.
- c.– Sida/SAREC shall diversify the mechanisms of cooperation by supporting new initiatives such as postdoctoral training and links between projects in different research areas supported or intended for support by Sida/SAREC, at the Universities or in other national institutions.

IV. LONG TERM RECOMMENDATIONS FOR SIDA/SAREC

- a.– In order to initiate a new era in the reinforcement of research capabilities, Sida/SAREC shall secure the continuity of the educational process at graduate level.
- b.– Sida/SAREC shall secure and strengthen the continuity of the cooperation on the grounds of University priorities and objectives as well as in the development of research activities

*Understood as a permanent and independent capacity for training of human resources, ability for the management of funds, capacity for obtaining and maintaining equipment, requests based on research capabilities etc.

**Within the National and regional context, linked with governmental, productive, industrial enterprises etc.

12.16.2. Spanish version

“COOPERACIÓN EN INVESTIGACIÓN ENTRE SUECIA Y NICARAGUA: PASADO, PRESENTE Y FUTURO” Asamblea General, Febrero, 2002

Resumen preparado por: Edmundo Torres, UNAN-L; Charles Wallace, UNAN-M, Freddy Alemán, UNA y Leonel Plazaola, UNI. Febrero 2002, Managua, Nicaragua

I.– A UNIVERSIDADES (Corto Plazo, 1 a 2 años):

- a.– Establecer las normativas de las actividades de investigación, de tal forma que esta se institucionalice y se instauren las bases que aseguren la pertinencia, sostenibilidad* y continuidad de la misma.
- b.– Definir y desarrollar un proceso permanente de identificación de las prioridades de investigación en la Universidades, basándose en la demanda de soluciones a los problemas de la sociedad**

- c.– Crear un sistema de investigación entre las cuatro Universidades (UNAN-L, UNAN-M, UNI y UNA) que permita la organización de grupos interdisciplinarios e interinstitucionales, compartiendo y consolidando las fortalezas existentes y promoviendo la gestión de proyectos en este marco.
- d.– Iniciar un plan de amplia información sobre los objetivos y logros de las actuales actividades de investigación.

II.– A UNIVERSIDADES (Largo Plazo, 2 a 4 años):

- a.– Replantear y transformar la organización y gestión de las Universidades como un sistema que fortalezca y asegure la sostenibilidad de la actividades de investigación.
- b.– Establecer la articulación con el resto de instituciones estatales, para en conjunto asumir el compromiso de impulsar la ciencia y la tecnología para el desarrollo nacional.

III.– A SAREC/ASDI (Corto Plazo):

- a.– Apoyar el fortalecimiento y desarrollo de la organización y gestión de las Universidades, para poner en marcha el sistema de fortalecimiento y sostenibilidad de la investigación.
- b.– Apoyar la promoción de vínculos entre las Universidades y la sociedad civil, orientados al conocimiento y aplicación de los resultados de las investigaciones.
- c.– Diversificar los mecanismos de cooperación mediante el apoyo a nuevas iniciativas, tales como la promoción de la investigación post-doctoral o la promoción de los vínculos entre las áreas de investigación y otros proyectos financiados o a ser financiados por ASDI en otras instituciones del país.

IV.– A SAREC/ASDI (Largo Plazo):

- a.– Asegurar la continuidad de la formación de recursos humanos de alto nivel, que permita trascender a una nueva etapa en el fortalecimiento de la capacidad de investigación.
- b.– Asegurar la continuidad de la cooperación sobre la base del seguimiento de los retos y metas de las Universidades, en el marco del fortalecimiento y evolución de las actividades de investigación.

*Sostenibilidad entendida como la necesaria capacidad de formación y sostenimiento de recursos humanos, habilidad para la consecución de recursos financieros, aseguramiento de infraestructura y equipos, etc. demandadas por las actividades de investigación.

**En el contexto Nacional y Regional, vinculándose con los sectores estatales, productivos, empresariales, etc.

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