

Three Years of Collaboration in 'the Basic Sciences: Uganda-Norway

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Introduction

We are here to share ideas and experiences about ways to enhance the usefulness of research cooperation with institutions in the poorer countries, and I have been asked to share with you some of my experiences from a collaboration project in Basic Sciences between Makerere University, Kampala, Uganda and the University of Bergen, Bergen, Norway, a project which was started in May 1992.

We are all aware of the undeveloped potentials of youth in the developing countries and want to give our contribution to changing this unfortunate situation. As a background to the experiences over these years I shall introduce Uganda and Makerere University, as I see more and more the importance of having an understanding of the local situation before entering a development oriented collaboration project. After a description of the present project, I shall conclude with some observations of more general character.

I shall in the following refer to a university such as Makerere University - located in the South or in a developing country.

Uganda and Makerere University-

278 Uganda is an African country on the Equator with 19 million inhabitants of whom *only about 10 % live in urban areas*, and a total area of 236,040 km² of

which about 36,000 km² is covered by water and marshlands, including a large part of Lake Victoria. With an altitude mostly around 1100-1300 m, mountains reaching up to 5000 m and a reasonable amount of rain, Uganda is green and beautiful, as Churchill pointed out: "the Pearl of Africa".

25 - 30 years ago, Makerere University was called the "Harvard of Africa", having started out in 1923 as a University College and having been given a very good start through the many British staff members.

However, after the end of colonial times, Uganda went through nearly 20 years of civil war and other atrocities, with detrimental effects on production, development and essentially all activities in the country. 4-5 years ago, Uganda was rated among the 10 poorest out of 190 countries.

Makerere University was hit very hard, losing foreign staff and many Ugandan academics. The remaining staff was left with dwindling possibilities for operating the University at a reasonable level. The staff became academically isolated, without reasonable funding for books, laboratory instruments and other educational facilities.

When I visited the Department of Physics at Makerere University in 1988, I found the undergraduate laboratories in a deplorable situation. For nearly 20 years, there had been no new equipment nor spare parts available, and - in addition - thieves had stolen whatever electrical instruments were available, including switches, wall sockets, and motors. Even the cables had been pulled out of their tubes in the walls.

I found it admirable that the staff still was able to give the students a set of experiments to perform and to carry on an education with a curriculum asking essentially the same from the students as had been asked 20 years ago, even including a reasonable updating.

However, high school teaching was suffering as well, with little or no textbooks and no equipment for demonstrations or for students' experimentation - i. e. a weak basis for later university studies in basic sciences, clearly showing throughout all exams.

I wanted to take part in restoring the Department of Physics and searched unsuccessfully for funding from different sources for the following three years.

The Need for Infrastructure in the Basic Sciences in Uganda

Since 1986, when the present President of Uganda, Yoweri Museveni, came to power, the country has been developing at an accelerating speed, and with an increasing feeling of unity among the different sections of the country.

In this rapid development, with more and more international investment, there is a great need for highly educated Ugandans to take part - up to the highest levels - in the planning and running of the new enterprises. As in the North, the technology needed becomes steadily more advanced, and in order to cater to this - and to make relevant use of it - a general understanding of the basic sciences is necessary.

However, in a country with about 50% illiteracy and only very few literates with a complete primary school education, and where 90% of the population live in rural areas, it is imperative to also strengthen the primary and secondary school system, and to make schooling free of charge to keep children in the primary school. In order to develop the country without needing to settle a very large part of the population in a few large cities, schools all over the country have to be strengthened, with better education of the new teachers and an in-service training program for the present teachers.

Of particular importance is the teaching of basic sciences with direct relationship to local everyday life throughout the school system. This may develop an understanding of technical, physical and chemical principles which may help pupils in the rural areas to see possibilities for using these principles in developing their neighborhood, also economically, so as to reduce the unwanted rush to the larger cities.

Teachers with a feeling for the usefulness of physics, chemistry and mathematics are needed, even in the rural areas. To develop good teachers, one needs good scientists with research backgrounds at the universities, and both teachers and scientists in physics and chemistry need experimental equipment. Industry will need high school graduates as well as university trained people with a practical understanding of the technical, physical and chemical laws and principles.

The Start of the Project "Basic Science for Technological Development in Uganda"

When the Norwegian Ministry of Foreign affairs in 1991 started a funding agency named NUFU, an acronym for the Norwegian equivalent of The Norwegian Universities' Committee for Development Oriented Research and Education, I applied for funding, not only to form a cooperation project with Makerere University in physics, but actually in the basic sciences - physics, chemistry and mathematics, including science education. The project name chosen was: "Basic Science for Technological Development in Uganda", a real challenge.

The primary purpose of the NUFU policy is

"to contribute towards the strengthening of the research and educational competence of universities and research institutions in developing countries".

Note that this policy aims at the *development of the institutions*, not of individuals for their own sake.

This is to be carried out through

- joint research projects,

The Activities of the Project

Following the policies of NUFU, the whole program is developed with a basis in the requests of the academic staff in the departments involved through a coordinator for each department in the North and in the South. I would like to briefly describe some of the activities carried out so far in each department, illustrating the uniqueness of the situation in each case.

Each department has a given budget from the project per year, and have to plan its use and decide on the priorities for the different activities, and in most cases to discuss the cases with their partner in the North.

Department of Physics

The department has 15 scientific positions, 13 of them filled, 4 persons with Ph.D. degrees and 4 now working toward their Ph.D. degrees. This leaves only 9 "full time" staff members at the department (due to low salaries they all have to hold extra jobs). Adding the number of 1st-3rd year students - about 270 - and there are about 25 different courses to teach by these 9+ persons.

- How do they get time to do research?
- How do they get time to revise and update the curricula, the laboratories?
- Where do they start?
- By now, the Program looks somewhat like this:

The teaching laboratories are being renewed with respect to choice of experiments, hardware and manuals. The 1st year is now complete, while the 2nd and 3rd are prepared far enough to allow students who take 1st year studies this year to follow up with properly renewed programs also in their next undergraduate years.

The theoretical curriculum will go through a more thorough renewal in a couple of years.

Research at the Department of Physics

The Clay Project: Uganda has many interesting clay deposits, and research was started two years ago on the physical properties of the clays, aiming at finding suitable insulating materials, building materials, ceramic materials

for electronics, etc. One professor in Bergen is deeply involved in this research together with a graduate student. The Department of Chemistry has also entered into this program, studying the chemical properties of the deposits.

Radiation Physics: Research on radon contamination at different locations in Uganda, including habitated areas, mines, etc., with its relationship to local health problems.

Electronics and instrumentation is a research field under development.

Solar energy: A survey of the insulation in Uganda is under development; another part of Solar Energy Studies is supported by IPPS, Uppsala, Sweden, with funding from NORAD, Norway.

Department of Chemistry

In 1992, the department had 16 staff members, 9 of them with Ph.D. degrees. The department has not had any graduate students for the last 5 years. This indicates the complete lack of funding for laboratory and research equipment, as well as an isolation quenching most initiatives.

For the 1st year laboratories, the department has purchased - with NUFU funds - so-called micro experimental equipment, making experimenting very much cheaper (the amount of chemicals needed is reduced to almost 1% of the former), safer, and easier with respect to disposal of the chemicals.

Revision of curricula and of the other laboratories are to follow in the next four year period.

Research: Research projects that have been started are

- i) studies of pigments in local plants, with possible medical applications,
- ii) studies of oils in local plants, with possible use in paints, detergents, food,
- iii) studies of oils in local fish, with possible similar uses, and
- iv) studies of pollution in Lake Victoria.

Bergen scientists and students are deeply involved in most of this research.

An important event in chemistry was the organization of The 6th NA-PRECA Symposium on Natural Products Research and Development, at

which two papers and two posters on the above research programs were presented. NAPREC A is the acronym for Natural Products Research for Eastern and Central Africa.

Department of Mathematics

With a staff of 3 members with Ph.D. degrees and 7 with M.Sc. degrees, this department concentrates on staff development.

Training of the staff through studies toward Ph.D. degrees with Norwegian advisors is a main activity, in addition to upgrading of the education of undergraduate and graduate students.

So far, academic contacts have been made through exchange visits, but the department is planning to reduce the number of travels by keeping more of their close international contacts through electronic mail and the internet. E-mail has already existed at Makerere University to a certain extent for a few years, but we hope very soon to have continuous connections via a geostationary satellite.

The research programs include applicable fields like biomathematics, with special emphasis on models of the spreading of contagious diseases, telecommunication networks and mathematical modelling with respect to the environment.

The first two M.Sc. degrees in mathematics under the NUFU program were awarded in 1994.

Department of Science and Technical Education (DOSATE)

The NUFU program includes only physics and chemistry education, while DOSATE also includes mathematics, biology, agriculture and physical training. DOSATE was started in 1984 and has had difficulties in recruiting staff. It has also been difficult to find science educationalists internationally, as this field is rather young.

The staff consists of one chemist (a Ph.D. in chemistry), one graduate student in chemistry, one Ph.D. student in physics education (working on a stipend in Canada), and - additionally - four M.Sc. in mathematics and 6 in biology. There are no Masters degrees in Education.

DOSATE wants to develop the curriculum in physics and chemistry with special emphasis on experimentation, an activity which in physics has to await the return of the Ph.D. candidate. In chemistry, different makes of

micro-scale equipment are studied with a view to introducing cheap and safe experimentation in high schools.

In addition to exchange visits for staff and the purchase of some laboratory equipment, DOSATE has over the last years organized workshops with foreign facilitators for the staff, usually including staff from the nearby Institute for Teacher Education, Kyambogo. The workshops have centered on training in science education research, but has also included "environmental education".

DOSATE is eager to run a program on the in-service training of science teachers, but this will have to be funded from a different source. In 1993, NORAD, Norway, financed a pilot project for in-service training of physics and chemistry teachers, but did unfortunately not follow up the project with further funding. However, we still hope to get them to continue.

Interdepartmental Activities

In addition to the above, I would like to mention the interdepartmental activities in the training of technicians which have been carried out in the experimental departments through workshops with Norwegian and Ugandan facilitators and courses held in computer science and data handling jointly - mainly for mathematics and physics - with Norwegian facilitators.

Several regional activities have also taken place with sponsorship from the project, and this type of activity will be strongly enhanced in the next four year period.

Generalizations

Makerere University, "The Harvard of Africa", lost its high level of research and education activities through the hardship imposed during many years of power struggles and bad political administration of the country. After the end of the civil wars, the University had to start up from a very low level, with very underpaid staff and very little funding for running the departments.

Makerere's strength was in its staff, which had a good educational background, be it as M. Ses or Ph.D.s, and did its utmost to keep the educational sector going.

While this is a special case, many African countries have similar backgrounds, so I believe that experiences from this project may make a useful background also for other projects of cooperation with South countries.

In order to develop a *sustainable* education and research environment, it is important that as many as possible of the activities rehabilitated through external funding are initiated by the South university staff.

Most of the senior staff members have degrees from foreign countries, having studied in a variety of specialities. Today, *most research work is performed in groups*, not by individuals. It takes some time to adapt to group work, to maybe have to leave one's speciality, but making use of ones research background is the main basis for further research in cooperation with others.

With the small numbers of staff members, *each department can only do research in a very limited number of fields*. In order to cover a larger number of fields, one is dependent on cooperation with stronger groups in neighboring institutions, in one's own country or in the region. *Regional collaboration will become increasingly important in the future, looking forward towards regional sustainable development*.

Revision of curricula and laboratory practicals carried out by the staff in the South is very *time consuming*, e.g. designing *relevant* experiments in physics, and locating the proper type components and/or instruments at a reasonable price, in most cases from firms in the North.

Starting up or reviving research projects *takes a lot of time*, which is spent on travel, studies to bring oneself up to today's state of the art in the field, search for collaborators, search for equipment, search for relevant computer programs, and even getting introduced to using computers for information, computation, modelling, etc.

I emphasize *the time aspects*, because the staff has so little time to spare for work outside teaching. The rest of the day is needed for earning enough money to take care of one's family. And, still, *for the sustainability* of the development, it is imperative that the South staff members are the main actors in all these activities.

The program has found it *important to remunerate certain parts of the development work*, such as the different aspects of revising curricula and laboratories, the performance of the coordinators' work, and also to add a monthly remuneration to M.Sc. and Ph.D. students. All remunerations are thoroughly discussed with the university administration in order that they comply with university policies. In fact, *a close and continuous contact with the administration both at departmental, faculty and the top level is important* for a relevant use of funds and manpower both from the South and the North.

Experimental activities, including the use of computers, requires *a well trained technical staff* for maintenance, repair and for constructing equipment. When being trained as experimentalists at universities in the North, South scientists frequently get too little feeling with all the things that can go wrong and the technical support which is required for the running of an experiment.

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Conclusions

The NUFU cooperation project "Basic Science for Technological Development in Uganda", having run from early 1992, has been carried out with the basic idea that South staff should take responsibility for defining and running the program themselves to as wide an extent as possible, looking forward towards a locally sustainable operation.

In order to optimize the strengthening of the local research environment, persons working towards their M.Sc. or Ph.D. degrees generally work in so-called sandwich programs, spending as little time as possible in the North for foreign guidance and research work, building up the research environment and facilities at the home institution while studying there.

It has been encouraging to experience the way in which Makerere University has made use of the cooperation facilities, each department tuning their uses to its particular needs, working in a very determined way to reestablish "The Harvard of Africa".