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RUFORUM Case Studies

Harnessing a University's Strengths to Build Research for the Region

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A Networks Approach

In East Africa, the three countries where the Strengthening Capacity for Agricultural Research and Development in Africa (SCARDA) gave support—Burundi, Rwanda, and Sudan—are all grappling with their own conflict-related challenges. While Burundi and Rwanda have been striving to reconstruct themselves after disastrous periods of genocide and civil war, Sudan, a country torn by long-standing and interlocking conflicts, split into two countries in 2011, when the southern region voted to secede from Khartoum.

For all three (now four) countries, hindered by severe shortages of highly trained scientists, amongst other things, SCARDA has offered a lifeline, particularly through the opportunities it provided for Masters level training for young scientists. SCARDA was able to capitalize on the pre-existing strengths of the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), a network for advanced training and research to support small- scale farmers and economic development in agriculture, which encompasses 29 universities across the Common Market for Eastern and Southern Africa (COMESA) region, offering specialized Masters and PhD-level training programmes.

As the lead service provider for SCARDA in the East African region, RUFORUM leveraged its pre-existing relationships with universities in the region, and in some cases provided training for SCARDA-sponsored students through its pre-existing MSc programmes. Because of the strength of its relationships with universities, the organization was in a good position to broker agreements and arrangements with universities to train students coming in from different countries and educational backgrounds, says Wellington Ekaya, the programme manager for RUFORUM who coordinated the SCARDA programmes. The purpose of RUFORUM is to train African researchers at the highest level, in an African environment, to equip them to make important contributions in areas of national priority— an objective which dovetailed with SCARDA's aim of capacity strengthening.

The Network's approach of harnessing the strengths and pockets of expertise that exist within particular universities, in order to build training and research capacity across the broader region, has gained credence in recent years as an effective way to deliver top- calibre advanced training in Africa, where experts and resources are typically thinly spread. Since 1994, RUFORUM has illustrated the effectiveness of this approach in agriculture, by contributing towards building up a cadre of high-level researchers and academics in fields such as plant breeding and drylands resource management. While each particular programme, such as plant breeding, is concentrated in one country, the benefits of the programme are shared across a wider region, as students from other countries are able to access training through the network.

Bolstering Food Security and Economic Recovery

SCARDA sought to take an integrated and holistic approach to capacity-building. Through the programme, institutions supported by SCARDA made use of tools such as "institutional analysis" in order to determine their key needs and priorities and better understand their roles in the larger agricultural systems within which they operate. One of the greatest needs across the institutions was for Masters training. Through the process of institutional analysis, key research priorities were identified, and suitable students were then selected for Masters training in those areas.

At Makerere University in Uganda, SCARDA-sponsored MSc students took part in RUFORUM's plant breeding programme. Building home-grown agricultural research capacity in plant breeding is extremely important for food security, says Prof. Paul Gibson, the programme's lead instructor. The diversity of different climates, soil types, and terrains found across the continent is yet another challenge for food security, as there is a need for scientists to produce varieties adapted to thrive in a variety of different local conditions. A variety of maize that thrives in the Ethio-pian highlands, for example, may be completely inappropriate for Rwanda. And Ethiopia in and of itself has a whopping 43 different crops that are vital to food security.

With climate change, the challenge becomes even steeper, as the imperative grows for plant breeders to develop increasingly resilient varieties that can resist all manner of pests, crop diseases and environmental stresses. Already, a full fifty percent of the continent's harvest is lost to pests and diseases, says Prof. Gibson.

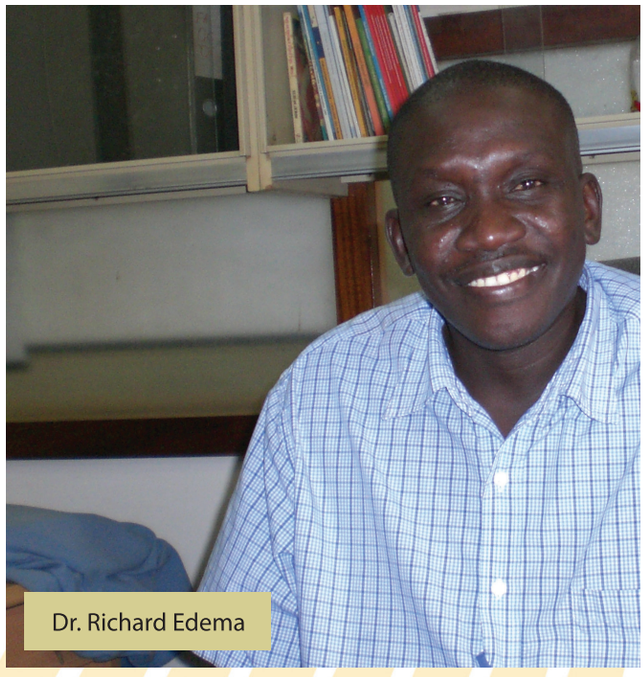
Rainfall patterns in many areas, meanwhile, are growing more variable and unpredictable, which poses a steep challenge to African small farmers who have no other means of irrigation. Increasingly, farmers need both water-efficient crops, and also crops which can survive waterlogged conditions.

Despite its food security challenges, however, globally Africa remains one of the few places in the world that has considerable capacity to increase its food production. Worldwide, the high-producing countries are about at their maximum—Africa is one of the few remaining regions on Earth with the potential to increase its food production—but to do so without destroying its fragile environment is yet another steep sustainability challenge. Clearing forests to plant crops, for example, has a direct impact on rainfall patterns; yet poor farmers face short-term economic imperatives to cut down trees for charcoal, and to slash and burn forests to plant more crops.

In East Africa, SCARDA provided funding for 5 students from Sudan (including South Sudan, now a separate country), 6 students from Rwanda, and 2 students from Burundi.

In South Sudan, Africa's newest country, for example, two SCARDA graduates, Lado Maurice Mogga and Luka Otwako Opio Awata have returned home and are already making important contributions on the ground, doing critical work for the country's fledgling Ministry of Agriculture. Most recently, Mogga, a rice breeder, and Awata, who works on maize, received funding from the Alliance for a Green Revolution in Africa (AGRA) to develop the country's plant breeding programmes.

Dr. Richard Edema, a plant pathologist by training who together with his colleague Dr. Patrick Okori designed the plant breeding programme at Makerere, says that addressing human capacity needs for emerging nations such as Rwanda and South Sudan will lead to concrete gains for food security and prosperity in the region. *"These are human beings, deployed in very strategic places, developing the varieties that fit local needs,"* he says.



Dr. Richard Edema

Now that money is flooding into South Sudan for post-conflict reconstruction, it is important to have well-trained people there who can use the funds to accomplish things, Dr. Edema says.


Abel Sefasi

Prof. Gibson's teaching emphasizes the importance of working towards food security. *"[Students] go back with the focus that your objectives need to be on what will have the most impact on the food security situation,"* says Prof. Gibson. Food security has become an increasingly acute problem since the division of South Sudan in 2011. Even in the north of the country, food prices have increased; while in South Sudan the food situation appeared critical in December 2011, as the World Food Programme announced that more than 2.5 million people would require food aid, due to crop failures and high food prices resulting from erratic rainfall, conflict, border closures, and market disruptions due to tensions with Sudan.

Designing Programmes for Complex Needs

For Dr. Edema, developing the plant breeding programme was a major challenge. Students often entered the programme with weak scientific backgrounds and language difficulties. There was a lot of ground to cover, and a lot to cram into a two- year programme, particularly because the students all wrote research-based theses on top of their coursework. In addition, the programme included a whole suite of soft skills in areas such as proposal writing, social research, and marketing which can sometimes be just as important for African scientists who need to be able to communicate about their work.

Dr. Edema and Prof. Okori sought input from a wide range of stakeholders in designing the course, weaving in a diverse selection of topics like marketing, social research, and business management. *"We kept asking [stakeholders]: if we are to train for you, what kind of person would you like to have?"* Dr. Edema recalls.

"In the U.S., I take students with good academic backgrounds and train them to become technicians or PhD candidates, where they're under guidance and there is a period of professional growth," says Prof. Paul Gibson. By contrast, the SCARDA-sponsored MSc students had often already been saddled with huge responsibilities for running national programmes back home, for which they were ill-prepared.

The relationships increase the pool of supervisors available to students, as well as the range of expertise in certain crops on which students are working.

One answer was to draw in other institutions operating within the National Agricultural Research System (NARS), such as the National Crops Resources Research Institute (NaCRRI). *"We decided to make it very practical and hands-on, so that as students were doing their work, they were learning how a real breeding programme works,"* says Dr. Edema. The importance of building relationships with the other institutions like NaCCRI, which increases the university's capacity to provide training, and strengthens the linkages between the different institutions.

"The principle of linking these things is so critical, and it's often very difficult to do that on a formal institutional basis," says Prof. Gibson. *"What has happened here is that people see the benefit of cooperating, and it's becoming part of the institutional culture, even though very little has been formalized."*

> *"The challenges of sustaining the programme are ongoing, particularly in light of the ongoing capacity challenges. Not only are African countries starting from a lower base, lacking the critical mass of experts that developed countries have—but each person trained is also much likelier to advance to a managerial role much more rapidly, due to the personnel shortages across the system. The average scientist will have to be replaced within 10 years, which puts even higher demands on the trainees"*
>
> Prof. Gibson


Mayada Mamoun Beshir

The Plant Breeding Challenge

Not only does Africa need more plant breeders; but the challenges of producing new varieties on the continent are steep. Using conventional plant breeding methods, it can take as long as 10 years to come up with new varieties.

For this reason, biotechnology is an increasingly important tool in plant breeding. While some forms of biotechnology like genetic engineering are controversial, the majority of students in the plant breeding programme gain at least some experience in working with genetic markers in plants, Prof. Gibson says.

For example, Sudanese student Mayada Mamoun Beshir's Masters research involved developing molecular markers for a fungal disease, turcicum leaf blight, in sorghum, cross- breeding one variety resistant to the disease with another that was highly susceptible to it, yet favoured by farmers for other properties.

"In Sudan, we are sorghum people," she says. In terms of area, Sudan plants three times more sorghum than the United States, yet the harvest is only a third of the yield in the U.S. According to Beshir, the problem illustrates the manifold problems of productivity in Africa: crops are rain-fed instead of irrigated, and crop diseases are widespread. *"When I came here, I wanted to do work on sorghum using molecular markers. We have high-yield varieties, but we don't produce high yields."*

After earning her Masters degree, Mayada wanted to continue with her PhD at Makerere, where her supervisor, Prof. Patrick Okori, is a renowned expert in sorghum improvement. Getting a PhD is an increasingly rare opportunity in Sudan, and she felt that it would give her a good opportunity to gain deeper skills to contribute when she returns, and forge lasting linkages between Makerere and the University of Khartoum, where she completed her first degree. *"Now I have experience in sweet potatoes, bananas, maize," she says. "I can fit wherever Agricultural Research Corporation would like me to fit in."*

Through SCARDA, she has been able to visit the Biosciences eastern and Central Africa hub, a Centre of Excellence for molecular markers, managed by the International Livestock Research Institute in Kenya. She has also attended conferences in biosafety, developing a poster and presentation. And she attended RUFORUM's bi-annual conference in Entebbe in 2010. She also recently received a scholarship to present her work at the African Crop Science Conference in Mozambique where her research on sorghum improvement was awarded the overall best prize for work likely to have high impact on smallholder agriculture. According to her mentor Dr Patrick Okori, this is a clear testimony that the training programme was well designed to contribute to Africa's development agenda, and that African Universities are indeed playing a very significant but often unrecognised contribution to their country's development and economic growth.

Importance of Linkages for Returning Graduates

For graduates returning to Rwanda or South Sudan, the importance of these linkages and relationships established with classmates and mentors from across the region cannot be overemphasized. Maurice Mogga and Luka from South Sudan, for example, met visitors from AGRA at Kabanyolo who ended up giving them the funding.

The students gained friends from other regions; developed joint proposals together; and were able to understand each other's context and offer moral support, Mayada says:

> *"When I came here, I felt alone because I didn't know English. Everyone came from different institutions, even the Sudanese. It was a great opportunity for us to become one. If you came from the lab or the field with a problem with an experiment, we would all get together and discuss it."*
>
> Mayada Mamoun Beshir

It was difficult at first to adapt to classes in English, but with help from her lecturers and colleagues, she pulled through. The work was also intense: during the second year, students attended classes five days a week and worked on their research two days a week. They attended training workshops in proposal development, taught by staff members of the African Crop Science Journal.

She also benefitted from the soft skills workshops led by the Institute for People, Innovation and Change in Organisations (PICOTEAM), the organisation that facilitated short training programmes for SCARDA-supported institutions. *"That was the first time, as a young scientist, to sit with the Director-General of my research institute,"* she says. *"Now you see yourself as an equal: you can attend meetings, give your ideas."*

For Mayada, it was the first time she had the opportunity to sit down with senior management at ARC, and have a discussion as equals. The challenges of ARC, she says, is that 90 percent of its money comes from the government, so the organisation does not have autonomy, and is bound by policies that often do not support research. Another problem is that ageing researchers on the verge of retirement are not being replaced by younger colleagues, which ties in to the problem of inadequate training opportunities for younger researchers.

Impact of SCARDA on the Host Universities

In the end, SCARDA not only benefitted the MSc students and their organisations, but also brought back benefits to the universities where the students trained, says Dr. Wellington Ekaya. *"Universities are beginning to see the need to produce a functional graduate with extra skills, proposal writing, and communication, even simple things like styles of how to present,"* he says. *"It's not only students who need these extra skills... having your PhD doesn't mean you know how to communicate to person who is not a scientist, how to write a proposal, how to formulate a paper or presentation. SCARDA managed to catalyze that realization within universities."*

Dr. Ekaya also said the SCARDA training approach introduced a new kind of mindset to university training, in which students were challenged with tight deadlines and rigorous coursework, yet at the same time consciously set up to succeed rather than fail. *"It doesn't make sense to have students only begin thinking of research after they have finished their coursework,"* he says. As the programme demonstrated, both can be done simultaneously.

"The programme is an investment in the students, and you mentor them," he says, which runs counter to the universities' typical approach of *"waiting to draw the mark to separate who has passed, who has failed... This was an unfair kind of approach, and SCARDA demonstrated that support for the weaker students ensures that they pass and catch up with the rest."*

For example, Yazan Elhadi Mohammed, a Sudanese student who went to the University of Nairobi under SCARDA sponsorship to obtain his Masters in dryland resource management, could barely speak English when he first arrived on campus. Ordinarily, university policy would not have allowed him to study without being proficient in English. Dr. Ekaya had to jump through bureaucratic and practical hoops in order for the university to agree to allow Mr. Mohammed to adjust his programme so that he could first study English.

Once proficient in the language, Mr. Mohammed performed with aplomb, and is now a doctoral candidate, expanding on his Masters research on the interactions of poverty and seasonal climatic variability, whom the university has also hired as a tutorial fellow, teaching economics. His success has been the basis of new relationships being formed between his former institution, the University of Kordofan, in Sudan, and the University of Nairobi. This relationship, he says, could help Sudanese institutions, often isolated and inward-looking, to overcome their insularity.

Indeed, returning from the supportive university community environment to far-flung research stations in their countries of origin has been a challenge to some students. Dr. Ekaya and his colleagues hope that the MSc programmes provided a strong enough foundation so that they will be able to sustain their research activities, publish, collaborate with their peers across distances and despite the pressing demands of their day-to-day work back home.

In order for the achievements of SCARDA to be built upon, he says, the students will need to be able to access opportunities for further training so they can reach the level of their peers in countries like Kenya and Uganda with more strongly developed research systems. *"In a country like Kenya, any person in a senior management position has a PhD, plus experience,"* he says. *"In a low-capacity country, in that same position you get a freshly graduated Masters. If you talk about quality research, delivery and meeting the needs of the poor, it's not enough. Otherwise, in the international community, everybody's talking above your head and you can't push your agenda."*

In order to get students started on collaborative research and paper-writing, Dr. Ekaya and ASARECA Focal Person Joseph Methu arranged a re-integration process for the students, which consisted of meetings in Nairobi and Kigali, where the students together drafted research concept notes in order to attract funding for projects they could work on together after their graduation. *"We hope it will take off,"* says Dr. Ekaya. *"This will hopefully give them a bit of a launch pad."*

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