STRENGTHENING CAPACITY FOR AGRICULTURAL RESEARCH FOR DEVELOPMENT IN AFRICA

Strengthening Institutional Capacity through MSc training: Lessons and Experiences from the Masters training under the SCARDA Programme in the ASARECA region

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List of Acronyms

AGRHYMET	Centre Regional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationnelle, Niger
ARC	Agricultural Research Corporation, Sudan
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
CORAF/WECARD	Conseil ouest et centre Africain pour la recherche et le dévelopement agricole / West and Central African Council for Agricultural Research and Development
CIMMYT	International Maize and Wheat Improvement Centre
DFID	Department for International Development, UK
ECA	East and Central Africa
ESAMI	Eastern and Southern African Management Institute, Tanzania
EDULINK	Cooperation Programme in Higher Education between African, Caribbean, Pacific group of states and the European Union
ILRI	International Livestock Research Institute
KARI	Kenya Agricultural Research Institute
NARI	National Agricultural Research Institute, Gambia
NARS	National Agricultural Research System
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SADC/FANR	Southern African Development Community/Food, Agriculture and Natural Resources Directorate

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Executive Summary

Strengthening Capacity for Agricultural Research for Development in Africa (SCARDA) was a continent-wide programme of the Forum for Agricultural Research in Africa (FARA) operating from 2008-2011. The purpose was to improve the capacity and performance of participating National Agricultural Research Systems (NARS) in key areas of their agricultural research for development functions by linking them more closely with universities and into innovation platforms. SCARDA had four key outputs;

(i) Agricultural research management systems and managerial competencies to conduct high quality research strengthened in participating NARS,
(ii) The capacity of participating NARS to undertake quality agricultural research for development strengthened,
(iii) The relevance of training programs in agricultural universities to current market demand established, and
(iv) The SCARDA approach for capacity strengthening validated.

SCARDA was implemented in 12 focal institutions (FIs) within their respective NARS in 10 countries[1] in 3 sub-regions. The Programme was coordinated by the FARA Secretariat and implemented by the sub-regional organizations, i.e. ASARECA[2], CORAF/WECARD, and SADC-FANR each supported by a Lead Service Provider - RUFORUM[3] for ASARECA, AGHRYMET for CORAF/WECARD and ANAFE for the SADC region.

The primary focus of the capacity development initiatives through SCARDA in the ASARECA region was support to post-graduate training and the enhancement of the skills of local NARS staff. The priority areas for Masters training were discussed and established with stakeholders after considering the results of the commissioned scoping studies and institutional analyses. The key areas identified for training included;

(i) Plant and animal breeding and biotechnology,
(ii) Agronomy,
(iii) Dryland management,
(iv) Research methods,
(v) Agricultural information and communication management (AICM),
(vi) Agricultural extension, and
(vii) Soil and water management.

RUFORUM as the Lead Service Provider had the responsibility of matching the focal institute training needs and priorities to universities with comparative advantage in the specific field of training. Five universities[4] were selected as intensive training hubs and these were accredited by ASARECA. The Sudan Academy of Science was also used for M.Sc. training in Sudan.

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[1] Botswana, Burundi, Democratic Republic of Congo, Gambia, Ghana, Lesotho, Mali, Rwanda, Sudan, Zambia,

[2] ASARECA – Association for Strengthening Agricultural Research in Eastern and Central Africa

[3] RUFORUM – Regional Universities forum for Capacity Building in Agriculture

[4] Egerton University, University of Nairobi, Jomo Kenyatta University of Agriculture and Technology (Kenya), Makerere University (Uganda), and Sokoine University of Agriculture (Tanzania)

SCARDA (ASARECA) produced a total of 34 Masters graduates in diverse fields of specialization. All the graduates have been re-integrated into their Focal Institutions in their home countries. As a result of the Masters training, a number of them have either been promoted or assigned special responsibilities within the institutes. Two of the graduates have proceeded for PhD training at the request of their home Focal Institution (FI).

The training approach used was holistic, going beyond the curriculum prescribed by universities. Students under SCARDA (ASARECA) went through short skill enhancement courses in areas of weakness identified among the students. These included Proposal and technical writing, scientific data management, and personal mastery and soft skills. Tailor-made, short, skill enhancement courses e.g. in research methods, were also designed for lecturers. Special arrangements were made by individual universities to help students that had weakness in English language. All students had a chance to attend at least one major conference to present results from their Masters research. The conferences provided excellent opportunities for students to sharpen their skills on how to interpret data, make presentations, posters, flyers and brochures, learn from each other and senior scientists, critique each other's work. Such opportunities were instrumental in developing confidence, building networks and transforming the young scientists into functional professionals at an early stage of their career paths. During their training, the students formed a community of practice across institutions. They have continued to collaborate individually and at institutional level after graduating. These linkages were initially facilitated by ASARECA and RUFORUM through a workshop, where the students produced three draft research concepts as a launch pad for their future collaboration and continued networking.

The structure and process of implementing SCARDA triggered several changes in the way universities conduct graduate training. There is a more intensive follow up and reporting approach both from students and their supervisors, particularly in universities that trained students under SCARDA. This sort of interaction propels the students to confidently work hard towards completing their studies on time. Student mentorship is increasingly being integrated into the training, including analyses of skill gaps in both students and lecturers. Skill enhancement courses have become more acceptable as part of the training process in many universities, and their added value to the degree training has become more visible and appreciated.

The SCARDA programme, despite the successes it registered, experienced a number of challenges. The overarching challenge was that the original design, as captured in the project logical framework, was quite ambitious. Three years was too short a period to transform the capacity of research management and the quality of scientific research in the focal institutes. Partners implementing SCARDA often felt that the management structure was overly complex, involving too many layers and actors, often with no clear command and communication lines. This affected the smooth implementation of the different components of the program in different ways and to varying extents.

The task of creating formal working relationships between the implementing partners was quite complex and time consuming. Often there were difficulties with communication and delays in implementation confounded by the unpredictable and erratic nature of funding flow that partners experienced. The process of implementing the M&E system for SCARDA was also a challenge. The process was too detailed and complex for most of the implementers of SCARDA, and was not well understood.

There were also a number of challenges specific to the Masters training which formed the core of the capacity enhancement in ASARECA;

i. Planning, reflection, sensitization of partners prior to start of SCARDA was not adequate, coupled with inadequate engagement of universities at the start of SCARDA. Furthermore, there was no budgetary provision made for networking, coordination and promotion at university level. This made it difficult to meet the targets and meant leveraging resources from elsewhere and overtaxing those involved but the additional effort was important to success.
ii. The innovative and sometimes complex nature of SCARDA needed more resources and effort than had been envisaged. There was no provision for contingency plans for the training programs to accommodate realities of training in universities, for example, late completion due to unexpected research failure, medical cases, and travel.
iii. Implementation of the SCARDA approach required flexibility in institutions as has been illustrated by the example of students from Sudan. A Sudan M.Sc. student at the University of Nairobi had to defer first semester courses to learn english, join the second semester before doing the first semester courses. However most universities run on rather rigid systems and especially as the approach tended to be new or even strange to university management, this often required additional time from facilitators.
iv. Student research was originally planned such that they would conduct research in their home countries under the supervision of FI senior staff and university supervisor. This did not work for most students, *inter alia* due to research time constraints, coupled with the requirement for resident course work, and scarcity of resources. This inability to send students to home institution for research created a mismatch between what was on the ground in terms of on-going research projects, facilities, technical backstopping, resources and student demands. It also undermine; one of the objectives of the programme, which was to strengthen the home institution and also add to the body of knowledge in the home countries. This failure therefore reflects the need to invest more time in facilitating sandwhich programmes if they are to be effective.

SCARDA programme partners articulated the following as the main lessons learnt;

i. The success of any capacity strengthening initiative is dependent on an in-depth and participatory institutional analysis as a first step, to identify the capacity strengthening needs, prioritize and engage the beneficiaries, implementing partners and relevant external stakeholders. The rigor of this analysis very much determines the relevance of the capacity strengthening approach.
ii. Building social capital and providing effective opportunities for networking and subtle mentoring are essential to a sustainable capacity strengthening programme. Furthermore there needs to be the facility to bring stakeholders on board. This all takes time and resources but the results of investing in fostering good relationships and networks are visible in the quality of the graduates and the satisfaction of the FIs involved,
iii. As the programme was being implemented partners realized that there was a general weakness in M&E capacity in the FIs and satellite institutions. To meet its performance criteria, SCARDA was therefore dealing with two issues, i.e. establishing M&E systems and building M&E capacity. Any programmes to enhance capacity need to take into account what is required to address M&E gaps.

Overall the experience with SCARDA in ASARECA showed that capacity for running quality graduate training exists in ASARECA requires harnessing and managing to fully unlock the great potential that exists. There is need to encourage more exchanges between universities to leverage synergies. In addition the comparative advantages of the various players in the NARS are yet to be fully exploited and will remain hidden within institutional walls unless we overcome lack of confidence,

inertia and lack of exposure. The SCARDA programme showed that engaging the staff in further education which harnesses their capacity through exposure to other institutions and experiences and expertise in the region develops individual capacity, strengthens the national institutions and provides a much wider base of expertise through the networks being built. At the same time through their applied research projects and theses they address problems, learn more participatory research approaches and get access to experienced and internationally respected academics. Universities will only have sustained impact in the region if they, *Inter alia*, enhance networking and collaboration in addressing regional challenges tailor their programmes to respond to market needs - as was the case with M.Sc. training in ASARECA.

Overall, in the SCARDA approach demonstrated the value of embedding capacity development (M.Sc. training) as part of the overall instituitonal strengthening.

1.0. Background

Strengthening Capacity for Agricultural Research for Development in Africa (SCARDA) was a continent-wide programme of the Forum for Agricultural Research in Africa (FARA). The goal of SCARDA was *to substantially and sustainably enhance the NARS contribution to poverty reduction in sub-Saharan Africa*. The purpose was *to improve the capacity and performance of participating NARS in key areas of their agricultural research for development functions*. The articulation and framing of the SCARDA agenda involved a three-stage process:

i. The FARA/NARS retreat of 2003 which sought ways to strengthen the agricultural agenda in Africa,
ii. A review of the NARS commissioned by FARA in 2005. The review identified two major weaknesses of the NARS, i.e. weak capacity to conduct quality research and weak capacity to manage national agricultural research systems,
iii. In 2007, scoping studies were commissioned by FARA and the findings were used to frame the SCARDA agenda.

SCARDA had four key outputs specified as follows:

i. Agricultural research management systems and managerial competencies to conduct high quality research strengthened in participating NARS.
ii. The capacity of participating NARS to undertake quality agricultural research for development strengthened.
iii. The relevance of training programs in agricultural universities to current market demand established.
iv. SCARDA approach for capacity strengthening validated.

SCARDA was implemented in 12 focal institutions (FIs) within their respective NARS in 10 African countries spread across the three sub-regions of sub-Saharan Africa. The Programme was coordinated by the FARA Secretariat and implemented in accordance with the *subsidiarity principle* by the sub-regional organizations (SROs), viz.: ASARECA, CORAF/WECARD, and SADC-FANR. The implementing SROs were each supported by a Lead Service Provider (LSP) namely, RUFORUM for ASARECA, AGHRYMET for CORAF/WECARD and ANAFE for SADC/FANR. The participating Focal Institutions (FIs) were:

In ASARECA sub-region: Institut des Sciences Agronomiques du Rwanda (ISAR, Rwanda), Institut des Sciences Agronomiques de Burundi (ISABU, Burundi), and Agricultural Research Corporation (ARC, Sudan).

In CORAF/WECARD sub-region: Crops Research Institute (CRI, Ghana), Centre de Recherches Agronomiques de Loudima (CRAL, Congo), Institut d Economie Rurale (IER, Mali), and National Agricultural Research Institute (NARI, Gambia).

In SADC/FANR subregion: Botswana College of Agriculture (BCA, Botswana), Department of Agricultural Research (DAR, Botswana), University of Zambia (UNZA, Zambia), National University of Lesotho (NUL, Lesotho), and Natural Resources Development College (NRDC, Zambia).

SCARDA also enlisted a number of service providers to facilitate various aspects of implementation, including the Natural Resources Institute (NRI) of the University of Greenwich from UK, which played an active backstopping role.

This discussion paper focuses on postgraduate (Masters) training of SCARDA in the ASARECA region, as part of SCARDA output 2. It discusses the approach, process and achievements, followed by a reflection on the experiences and lessons learnt. The paper is a contribution to the SCAIN (Strengthening Capacity for Agricultural Innovation in Africa) project, whose objectives are;

i. To document and disseminate the approaches, methodologies and key lessons from SCARDA. SCARDA developed tools and methodologies to identify and address capacity gaps in individual organizations. SCAIN explores how these can be modified to support capacity development in agricultural research partnerships, which involve different types of organization, including civil society groups and agribusiness.
ii. To review the evidence that capacity strengthening for agricultural research leads to measurable and sustainable impact.

2.0. Masters training – approach and process

The priority areas for training in each of the FIs were articulated through commissioned scoping studies and institutional analyses. These were further articulated and prioritized through consultation with the FIs. Table 1 below details the priority areas for Masters training articulated by the three FIs in the ASARECA sub-region.

The LSP had the responsibility of matching the FI training needs and priorities with the university with the comparative advantage in the field of training, followed by accreditation of the university by ASARECA. RUFORUM as the ASARECA LSP identified the relevant universities to provide the training (Table 2).

The universities admitted the students for 24-month Masters degree programmes, comprising coursework, examination and thesis. The timing of commencement depended on individual university's academic calendars.

The overall implementation of all SCARDA activities in the ASARECA region was overseen by a Project Management Team (PMT). The idea of a PMT was hatched during partner consultation meetings in 2008. PMT was responsible for all project deliverables as specified in the mutually agreed implementation plans and in accordance with Letters of Agreement signed between partners,

Table 1: Priority areas for Masters training identified by FIs.

Focal Institute	Priority areas for training
ISABU, Burundi	Plant breeding, Soil Science, Biometrics and Research methods, socio-economics, crop protection, irrigation and water management, livestock research
ISAR, Rwanda	Biotechnology (*in vitro* and molecular biology), post harvest technology, plant breeding, plant protection, agricultural extension
ARC, Sudan	Rangeland management, plant breeding, environment and resource economics, organic agriculture, agricultural information and communication management

Table 2: Universities accredited as service providers for Masters training and number of students from FIs trained*.

Focal Institute	Subject of Training	University Accredited	Number of Students enrolled
ISABU, Burundi	Soil Science/Agronomy	Sokoine, Tanzania	2
	Plant Breeding	Makerere, Uganda	2
	Research Methods	Jomo Kenyatta, Kenya	1
ISAR, Rwanda	Plant Breeding	Makerere, Uganda	4
	Soil Science /Agronomy	Sokoine Tanzania	1
	Animal Science	Nairobi, Kenya	1
	Animal Breeding	Egerton, Kenya	1
	Soil Science	Egerton, Kenya	1
ARC, Sudan	Plant Breeding	Makerere	3
	Rangeland Management	Nairobi, Kenya	1
	Plant breeding / Biotechnology	ARC-Sudan	4
	Soil and Water Management	ARC-Sudan	4
	Horticulture / Organic agriculture	ARC-Sudan	2
	AICM	Egerton, Kenya	1

***This table does not include the 7 seven students from satellite institutions trained under SCARDA, and 20 students trained from leveraged funds.**

and between universities and LSP. The PMT membership comprised of ASARECA, LSP, SCARDA focal persons, representatives from the FIs, and training coordinators at the respective universities.

RUFORUM as LSP was responsible for the overall management of the Master training, but working closely with the management of the respective universities, especially the programme coordinators directly responsible for the M.Sc. programme at each university. PMT meetings were scheduled

once every quarter, to review progress, share and document experiences and lessons and articulate quarterly work plans. The PMT was instrumental in realizing the achievements of SCARDA in the ASARECA region.

2.1. Holistic approach of the Masters training

The students underwent training beyond the approved Masters curriculum in the respective universities. The students went through several short (5-7 days) skill enhancement courses, in areas of weakness that had already been identified among these young scientists. The courses given to these students were;

i. Proposal and technical writing,
ii. Scientific data management,
iii. Personal mastery and soft skills.

The courses were organized by LSP by bringing the students from all the universities to a convenient central facility and courses delivered by experienced facilitators. In addition to the centrally delivered short courses, programme coordinators through their respective universities provided other skill enhancement courses to either all students or to those with special needs. For example, English language was a challenge for most students from French and Arabic speaking ASARECA countries. Universities made special arrangements for students to get enrolled for English classes. In some cases, the students were tutored in residence by visiting professors, as was the case in Makerere University. Within three to six months, the students were able to write and follow lectures in English effectively. A classic example and success story is that of Mr. Yazan from Kordofan University in Sudan. When he arrived at the University of Nairobi, he could only mention a few English words. The University enrolled him for English classes at the British Council. Three months later he was comfortably seated in the Master class. He was very strong in statistics and would coach some of his classmates. In exactly 23 months he graduated with a Masters Degree in Range Management. Three months later he registered for the regional PhD Programme in Dryland Resource Management, a three-year Programme with coursework hosted at the same university. Further, the university gave him a temporary appointment as a tutorial fellow to teach economics and dryland resource management to undergraduate students. Another Sudanese student (female) from ARC-Sudan finished her Masters on time and enrolled for the regional PhD Programme in Plant Breeding and Biotechnology at Makerere University under sponsorship by DAAD.

At Makerere University, the students benefited from a resident visiting professor and his wife. Apart from teaching the prescribed courses in plant breeding and biometry, the visiting professor gave extra coaching during weekends, after classes and during short holidays. His wife dedicated her time to teaching English to the students, and attending to social needs of female students.

A major challenge that most young researchers face is how to make effective public presentations. Under the SCARDA scholarship, each student had a chance to attend at least one major conference to present results from their Masters research. The main conference that brought all students together was the 2010 RUFORUM biennial conference held in Entebbe, Uganda and the African Crop Science Society Conference held in Maputo, Mozambique. The conferences provided excellent opportunities for students to get lessons from their supervisors on how to interpret their data, make presentations, posters, flyers and brochures. It was also a unique opportunity for the students to learn from each other, critique each other's work, learn from senior scientists and invited keynote speakers. Such opportunities were instrumental in transforming the young scientists into functional professionals at the early stage of their career paths.

3.0. Main achievements of SCARDA in the ASARECA region

3.1. Strengthening the capacities of NARS by training young innovative scientists with a unique combination of skills

In a period of 24 – 36 months, a total of 34 young scientists graduated with Masters Degree and were reintegrated into the FIs and satellite institutions. More significantly, each graduate had delivered research outputs much needed by their respective FIs. Except for the two students from Sudan currently registered for PhD studies, all the other graduates immediately went back to their respective institutions. The training made a difference with respect to their responsibilities at the work place. Tables 3a and 3b summarize the thesis/research titles and some comments by the graduates on the impact of the training on their working life and environment, respectively.

3.2. Self-forming Community of Practice

During their training, the students formed a community of practice across institutions. They felt the need to collaborate individually and at institutional level after graduating. To facilitate this emergent demand, ASARECA and the LSP organized what was known as graduate re-integration workshop. The aim of the three-day workshop was to provide a platform for the young researchers to think together and develop joint research and capacity building proposals for mobilizing resources to support their ideas. This facilitated process produced three innovative draft concept notes for further articulation by the gradates and their senior colleagues at the respective FIs. The focus of the three concept notes was guided by the research mandate and capacity building needs of the participating FIs. Universities were fully integrated into the proposals as main collaborators in both research and capacity building. The plan was to fully develop the proposals and submit to the EU-Edulink and EU-ACP (S&T) programmes for possible funding. The titles of the three concept notes were as below:

i. ISAR: Enhancing soil and water management for improved food security in Eastern and Central Africa region.
ii. ARC-Sudan: Enhancing Bulrush millet production in arid regions of East and Central Africa.
iii. ISABU: Enhancement of rice production and income generation for rural householders in East Africa.

3.3. Catalyzing change in universities towards business unusual

The structure and process of implementing SCARDA and what was achieved in a relatively short time triggered several changes in the way universities conduct graduate training.

3.3.1. Student supervision

The SCARDA approach was characterized by quarterly reporting by both the students and the supervisors, quarterly monitoring field visits by LSP to students, supervisors, and programme coordinators at universities. This close monitoring and interaction created rapport, confidence and trust among all participants. This made it quite easy to trouble shoot and address any potential challenges and causes of delay or derailment in student progress, in good time. This sort of interaction also gave the students impetus to confidently work hard towards completing their studies on time. This approach is now being adopted by Deans of Faculties in the universities that participated in the SCARDA programme. The other Deans of Faculties got to learn of the approach and its success through, *inter alia*, reporting by students, SCARDA management team

Table 3a: Masters thesis research topics of all students sponsored under SCARDA in the ASARECA region.

No.	Student Names	Country	Masters Programme	Research Topic
1	Lado M. Mogga	Sudan	Plant Breeding	Inheritance of resistance to rice yellow mottle virus disease in selected rice cultivars in Uganda
2	Mayada M. Beshir	Sudan	Plant Breeding	Introgressing resistance to *Turcicum* leaf blight and mapping of associated quantitative trait loci in sorghum
3	Luka O.O. Awata	Sudan	Plant Breeding	Heterosis and combining abilities for multiple resistance to *Turcium* leaf blight and maize streak virus
4	Micheline Inamahoro	Burundi	Plant Breeding	Characterization and mapping of root development in a segregating diploid banana population for resistance to *Randopholus similis*
5	Gafishi Kanyamasoro	Rwanda	Plant Breeding	Inheritance of resistance to maize weevil *Sitophilus zeamais* (Motschulsky) in maize inbred lines and determination of their heterotic groups
6	Fulgence Niyongabo	Burundi	Soil Science	Genetic studies of resistance to rice blast in upland rice
7	Uwizerwa Mathilde	Rwanda	Soil Microbiology	Optimization of rhizobium and arbuscular mycorrhizal fungi benefits for grain legume production in acide soils
8	Cyamweshi Rasangamwa	Rwanda	Soil Science	Strategy for improving bush bean production on a phosphorus fixing Andosol with aquic moisture regime

Table 3a: Contd.

No.	Student Names	Country	Masters Programme	Research Topic
9	Leonidas Dusengemungu	Rwanda	Agricultural Extension	Capacity for sustaining agricultural innovation platforms in Rwanda: A case study of Research Into Use project
10	Musa N.S. Abdalla	Sudan	AICM	Challenges facing research institutions in using information and communication technologies to disseminate agricultural information to farmers in Gezira State, Sudan
11	Umenezero Olive	Rwanda	Animal Science	Effects of supplementing napier grass with ram press sunflower cake on intake, digestibility milk yield and composition in dairy cows
12	Wilson Dufitumukuza	Rwanda	Soil Science	Effect of lime and NPK fertilizer formulations on soil chemical properties, tea yield and total leaf polyphenois in Gisovu, Rwanda
13	Sibomana I. Caroline	DRC	AICM	Growth and physiological changes of tomato as influenced by soil moisture levels
14	Banga Falasi Patience	DRC	AICM	Improvement of land use information flow for mangroves forest conservation and rural farming in Democratic Republic of Congo
15	Sseguja Fred	Uganda	AICM	Factors affecting pre-weaning growth of crossbred calves at Research Station in Rwanda

Table 3a: Contd.

No.	Student Names	Country	Masters Programme	Research Topic
16	Yiga Moses	Uganda	AICM	Use of information and communication technology in the dissemincation of agricultural information in Public Agricultural Research Institutes in Uganda
17	Simachew Manaye	Ethiopia	AICM	An analysis of language use and content in communicating agricultural technologies to farmers in Ethiopia
18	David K. Mbugua	Kenya	AICM	Information access and preference for delivery pathways by peri-urban and rural smallholder dairy farmers in Central Kenya
19	Andrew Musungu	Tanzania	AICM	Accessibility and usage of dairy cattle feeding information by small scale farmers in Morogoro urban in Tanzania
20	Habonayo Gloriose	Burundi	Soil Science	Comparative effect of farmyard manure, cowpea residues and NPK fertilizers on maize grain *(Zea mays* L.*)* yield in Morogoro
21	Cyrille Mbonihankuye	Burundi	Horticulture	Effect of pruning on yield and quality of selected indeterminate tomato (*Solanum lycopersicon* L.) lines
22	Manzi Maximilliane	Rwanda	Animal Science	Factors affecting pre and post weaning growth of crossbred cattle genotypes at Songa Research Station in Rwanda
23	Yazan Elhadi M.	Sudan	Range Management	The link between seasonal climatic variability and poverty: A case study of pastoral and agro-pastoral communities in Baringo District, Kenya

Table 3a: Contd.

No.	Student Names	Country	Masters Programme	Research Topic
24	Ntukamazina Nepomuscene	Burundi	Research Methods	Improving research methods on bean breeding at Burundi Agronomic Sciences Research Institute
25	Sufiana Mohamed Suilman	Sudan	Plant Breeding	Assessing genetic diversity among Sudanese sorghum accessions using molecular markers and phenotypic characterization
26	Atif Ahmend Mohamed Musa	Sudan	Plant Breeding	Study of combining and heterosis of grain sorghum (*Sorghum bicolor* L.) using (line x tester) analysis
27	Izz Eldin Ahmed Banaga	Sudan	Soil Science	Effect of nitrogen and phosphorus rates and sources on grain and forage yield of maize in the river Nile State
28	Mohmed Yousif Balla	Sudan	Plant Breeding	Genetic variability of soybean for yield and yield components under irrigation conditions of Gezira, Sudan
29	Ali Elkhazin Ali Yousif	Sudan	Soil Science	Effects of chicken and cattle manure on wheat production and soil properties in the high terrace and Karu soils in river Nile State
30	Khalid Hamdan Mohamed	Sudan	Soil Science	Effect of different types of organic fertilizers on growth, quality and yield of tomatoes sandy soil
31	Amel Osman Ahmed	Sudan	Soil and Water Management	Phosphorus sorption, desorption and buffering capacity as a guide for phosphorus availability of some selected soil series

Table 3a: Contd.

No.	Student Names	Country	Masters Programme	Research Topic
32	Amel Ahmed Ali Sidahmed	Sudan	Soil and Water Management	The effects of water stress on yield and productivity of two newly released wheat varieties
33	Mariam Abdalla Mohamed	Sudan	Horticulture	Evaluation of micro and macro propagation techniques of Gerbera (*Gerbera Jame* sonii) under different conditions
34	Ahmed Babiker Ahmend Khalifa	Sudan	Horticulture	Effect of drip irrigation system and fertigation on growth, yield and quality of banana cv. Grand Nain (*Musa* AAA)

and LSP in various media such as FARA General Assembly, RUFORUM biennial conference, RUFORUM monthly newsletter, the ASARECA Agri-Forum newsletter and FARA's SAFARI-CAP newsletter.

3.3.2. Student mentorship

University faculties were quite impressed with the extra activities that were part of the SCARDA package in the Maters training compared to other enrolled students. The extra unique activities included identification of skill gaps among students and lecturers and the design of remedial measures. Typical skill gap areas, which were addressed, included English language classes, data management, e-content development and proposal and technical writing. The deliberate linking of students to international and regional knowledge centres e.g. ILRI, CYMMIT, NARO and KARI for extra support e.g. leveraging resources for research is another aspect that faculties have vigorously adopted. In fact students who have graduated have picked it up and are themselves actively looking out for such opportunities and asking their supervisors and administrators for the required institutional support.

3.3.3. Managing language diversity

Proficiency in English is a precondition for admission to graduate studies in most universities in the ASARECA region particularly those that participated in the SCARDA programme. By participating in the programme, the universities have ameliorated this requirement and admitted sudents with English language difficulties. The administration then took up the extra responsibility to provide language support until the students were at a proficiency level enough to handle graduate work.

The successful and timely completion of study programme by students who originally had language problems has inspired universities to rethink the rigidity of admission criteria with respect to language proficiency. When they finally graduate, they not only go back home with a degree but with a second international language, often with a certificate from the British Council. This already opens up new opportunities for the young scientists.

Table 3b: Responses from graduates on the impact of Masters training on their work life and environment.

Name	Country	Professional changes and responsibilities attributable to the Master training (responses in graduates' own words)
Yazan Ahmed Mohamed Elhadi	Sudan	After my MSc. Degree, my employer released me again to continue studying to PhD level
Mayada Mamoun Beshir	Sudan	Immediately after graduating, my employer allowed me to proceed with PhD training at Makerere
Habonayo Gloriose	Burundi	There is a big change. I can now meet with my colleagues who are senior researchers, to jointly write research project proposals
Gafishi Kanyamasoro Martin	Rwanda	At the reorganization of our Institution that merged Research and extension, I was appointed Researcher in maize in the Northern Zone Division where I was designated focal person in Maize program. This is obviously a result of upgrading my studies. We have 4 Agriculture Zone Divisions and each program is represented by a focal person
Patience FALASI BANGA	DRC	Yes, currently I am the contact person of the knowledge management service (KMS) in DR of Congo. KMS allows information flow from the scientists or agriculture experts to respond directly to farmers' needs.

3.3.4. Strengthening national innovation systems

The student supervision arrangement under SCARDA involved close interaction and / or co-supervision involving senior scientists in the student's home FI. The original plan was to have students travel back home for their field research and have supervisors from the universities visit their fields and institutions. A supervisor from each FI was to spend some time at the student's university. Although this arrangement did not go strictly according to the plan, universities worked very closely with the FIs in identifying skill gaps in students and designing remedial measures, focusing student research to meet FI needs and academic quality, planning and identifying field sites, identifying local resource people and centres to augment student learning, and jointly planning for the students professional life after graduation. This interaction has continued and even moved to a higher level as students graduate. For example, supervisors from University of Nairobi and Sokoine University thereafter engaged scientists from ISABU, ISAR and ARC-Sudan in developing joint proposal targeting the 2012 EU-Edulink call. At another level, RUFORUM and ASARECA developed a joint proposal to pilot a two-year programme to strengthen weak NARIs and universities. Under this initiative, main activities include internships and support for visiting fellows, skill enhancement courses, Masters training and a limited number of PhD scholarships. The main principle is to leverage strong NARIs and universities to strengthen the capacity of their weaker counterparts.

3.4. Providing a platform for leveraging partnerships / funds for training and research

In the ASARECA region, the LSP was able to leverage partnerships and funds for more student scholarships for training under the SCARDA approach. The total leveraged funding was in the range of US$. 750,000. Table 4 gives a summary of students sponsored from leveraged funds.

Table 4: Master training from leveraged funds.

Service provider	Courses	Country	Number of Students	Funding Source
Makerere University	Plant Breeding Plant Breeding	Uganda Rwanda	6 6	AGRA AGRA
Egerton University	AICM AICM	Zimbabwe Uganda	1 1	RUFORUM RUFORUM
Sokoine University	Food Science Agricultural Economics Soil Science & Land Management	Sudan Sudan Uganda	3 2 1	DELPHE DELPHE RUFORUM
Kenyatta University	Agricultural Sciences	Sudan	6	DELPHE and RUFORUM

4.0. Main challenges and lessons learnt

4.0.1. Implementation challenges

4.0.1.1. Cross-cutting issues

i. A rather ambitious programme

The overarching challenge of SCARDA was that the original design, as captured in the project logical framework, was overly ambitious. As implementation gathered momentum, it became apparent that three years was far too short a period to transform the capacity of research management and the quality of scientific research. The design, through verifiable indicators, expected that by the end of the project there would be visible and measurable improvements in the management and delivery of research. It was not possible to achieve this within three years.

ii. Complex and often unclear management structure

Implementation partners often felt that the management structure adopted by SCARDA was overly complex, involving too many layers and actors (FARA-SRO-LSP-SP-FI). Often there wasn't clear command and communication lines. This affected the smooth implementation of the different components of the program in different ways and to varying extents. For example funds for Masters training had to be transferred from DFID to FARA, then to ASARECA, and finally from ASARECA to the various universities and FIs. Too much time was lost in this process, yet student time in the universities and particularly research time was getting lost. In the ASARECA region, it took the good will and flexible working relations between the SRO and LSP to ensure that student

training was not delayed or derailed in any way. Some student costs were pre-financed by the SRO or LSP as a stop-gap measure in the interest of the students.

iii. Formalizing working relations between partners, and getting them to the same level of understanding and involvement

One reason for delay in SCARDA implementation was the complex task of creating formal working relationships between such a large number of organizations including FARA, 3 SROs, 12 FIs (across 10 countries), 3 lead service providers plus a range of service providers. For example, exercising coordination authority of RUFORUM as the LSP to the universities providing service was often misconstrued to mean micro-management. RUFORUM had to navigate carefully and apply a lot of public relations to get things done. For example, SCARDA programme coordinators at university and students were required to submit quarterly reports to the LSP, for consolidation and submission to ASARECA by the LSP. The reporting by the students and coordinators was in addition to reporting requirements by their respective Faculties and Departments, not to mention that the formats were often sometimes at variance with each other. This process worked, albeit with lots of misgivings among the universities and students.

iv. Delayed and often intermittent disbursement of funds

The unpredictable and erratic nature of funding flow that partners experienced was a major disruptive factor in the implementation of SCARDA. It can be argued that this situation was further compounded by the fact that funds had to go through many institutions before reaching the final intended implementer or recipient. Activities got delayed, partners and students became anxious, credibility and relations were at risk of getting out of normal range, and all these slowed down the momentum of implementing the project.

v. Trying to implement a poorly understood M&E system

Implementing the M&E system for SCARDA was like implementing a separate project from SCARDA. The process was too detailed and complex for most of the implementors of SCARDA. Furthermore, it was not well understood. There were of course many concerted efforts to make partners understand and use it but still the M&E system was not implemented by the key stakeholders in a systematic manner. There was the weakness that the system laid so much emphasis on survey tools rather than building on M&E systems within the SROs and/or the FIs.

4.0.1.2. Issues specific for Masters training in the ASARECA region

i. Planning, reflection, sensitization of partners prior to start of SCARDA was not adequate. There was inadequate engagement of universities at start of SCARDA, therefore there was limited understanding and buy in beyond the Vice Chancellors, Deans of Faculties and programme coordinators. Furthermore, there was no budgetary provision made for networking, coordination and promotion at university level. Therefore the Masters training approach and unique requirements were often met with resistance from some sections of universities providing service. It took a long gestation period before universities could internalize the SCARDA Approach.

ii. The innovative and sometimes complex nature of SCARDA needed more resources and effort than was envisaged. There was no provision for contingency plans for the training programmes to accommodate realities of training in universities, for example late completion due to unexpected research failure, medical cases, and travel. There was also inadequate scholarship funds to meet the welfare needs of foreign students e.g. settling down, medical insurance, currency fluctuations. The great diversity in the academic and cultural background of students

required additional efforts and resources to cope with related requirements, as well as coordinating across disciplines and countries. This was not well provided for in the planning and financial budgeting. RUFORUM as the LSP took the responsibility of mobilizing additional resources to fill part of the gaps, while at the same time ASARECA renegotiated for some additional resource from DfID. Through these mechanisms, SCARDA was able to graduate all students.

iii. Internal weaknesses of the institutions, e.g. delayed reporting, limited support to programme coordinators, very slow response to student issues and limited internet connectivity slowed the speed of things at university level.

iv. Implementation of the SCARDA approach required flexibility in institutions as has been illustrated by the example of students from Sudan. However most universities run on rather rigid systems. The approach tended to be new / strange to university management. For example, it was not easy to convince universities that students would need to stay away from the university for one week to attend a short skill enhancement course like proposal and technical writing. This however worked through the intervention of programme coordinators and Deans.

v. Student research was originally planned such that they would conduct research in their home countries, under the supervision of FI senior staff and university supervisor. This did not work for most students, *inter alia* due to research time constraints coupled with the requirement for resident course work, and scarcity of resources. This inability to send students to home institution for research created a mismatch between what was on the ground in terms of on-going research projects, facilities, technical backstopping, resources and students demands.

4.0.2. Main lessons learnt

i. The success of any capacity strengthening initiative is dependent on an in-depth and participatory institutional analysis as a first step, to identify the capacity strengthening needs, prioritize and engage the beneficiaries, implementing partners and relevant external stakeholders. Clear understanding and buy in by all involved is crucial for the process. The rigor of this analysis very much determines the relevance of the capacity strengthening approach.

ii. SCARDA program only provided opportunities for Masters-level training, yet there was demand from the FIs and even service provider universities for PhD training. A good example is the case of University of Kordofan and ARC staff who proceeded for PhD immediately after Master training. All the FIs expressed the need for PhD training at the close of SCARDA.

iii. It became apparent to most partners that establishing M&E capability should have been an objective by itself. As the programme was being implemented it was realized that there was a general weakness in M&E capacity in the FIs and satellite institutions. SCARDA was therefore dealing with two issues, i.e. establishing M&E systems and building M&E capacity. This was difficult to achieve in the short lifespan of SCARDA

iv. Rigorous budget rationalization is key to the success of innovative regional initiatives such as SCARDA. The current costing of training programmes by universities only reflects national realities. Further, the cost of delivering quality graduate courses is currently under-estimated as it fails to capture the fact that universities are considerably subsidized on public funds.

v. The unique aspect of SCARDA was that the approach was holistic and focused on institutional rather than individual capacity strengthening. Therefore more rigorous support in organizational development through learning workshops would go a long way in improving the institutional and personal competencies of researchers in the FIs to complement and enhance the technical skills.

vi. Capacity for running quality graduate training exists in the ASARECA region, but requires harnessing and managing to fully unlock the great potential that exists. The comparative advantages of the various players in the NARS are yet to be fully exploited, the potential of targeted institutional networking and collaboration remains largely untapped, opportunities for mentorship and internships for students, young scientists, etc are yet to be adequately pursued. All these opportunities remain hidden within institutional walls most times. Universities will only have sustained impact in the region if they, *Inter alia*, enhance networking and collaboration in addressing regional challenges.

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